



TANGANYIKA TERRITORY

DEPARTMENT OF AGRICULTURE

Annual Report

1938



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DEPARTMENT OF AGRICULTURE

ANNUAL REPORT 1938

SECTION I.—GENERAL REVIEW OF THE YEAR

STAFF

On the 29th of March 1938, Mr E. Harrison, C.M.G., who had been Director of Agriculture for the Territory since the year 1930, proceeded on leave pending appointment as Professor of Agriculture, Imperial School of Tropical Agriculture, Trinidad. His achievements leave no doubt that the loss to the department and the Territory is a very heavy one. During Mr Harrison's service as Director we have seen the "plant-more-crops campaign," the initiation of soil conservation measures on a wide scale, the establishment of the coffee and sisal research stations (with assistance from the Colonial Development Fund) and the Ukiriguru and Itheme experimental stations, the Nyakato agricultural training centre and (with the aid of a financial grant from the Empire Cotton Growing Corporation) extension of cotton experimental work and the establishment of the peasant settlement centres at Kingolwira and Nyamahona, the establishment of statutory boards for coffee, cotton and sisal, the reorganization of the cotton industry, supported by funds granted by the British Cotton Growers' Association, and the progress of the new tea and sugar industries. The successful achievement of many of these projects would have been no mean feat in normal times, but they were initiated and carried out during the most depressed years when there would have been little surprise had the *tempo* slowed down somewhat. Mr Harrison's plans and objectives have proved so eminently sound and desirable for such a young country as Tanganyika, that to continue along the lines he has laid down is to assure progress in the economic development of the Territory with consequent inevitable improvement in the welfare of its inhabitants.

Mr A. B. Killick, of the Trinidad Agricultural Department, has been appointed Deputy Director and will arrive in April 1939. The strength of the departmental staff has not altered materially in the year but vacancies for one senior agricultural officer and one agricultural officer remain to be filled. The department's European staff is, however, inadequate to maintain existing services let alone provide for reliefs for leave periods or to meet the urgent demands which are constantly made by the Provincial Administration and by settlers for increased technical assistance.

CROP CONDITIONS

Both climatically and economically the season was quite one of the most unfavourable that the Territory has ever suffered. Over the whole of the country the main planting rains were seriously delayed, while in the Lake and Western Provinces, where crop planting is two months earlier than the remainder of the Territory, there was an almost complete failure of the December-January rains which resulted in food shortages amounting to severe famine in parts of the Western Province. Food shortages also occurred in the Mbulu district and it was necessary to prohibit the export of food-stuffs, including groundnuts, from several districts of the Lake Province. In some parts of the Eastern and Southern Provinces food was barely adequate. In the Southern Highlands Province long drought periods throughout the year seriously retarded the flushing of the tea bushes.

In addition to adverse climatic conditions restricting the tonnage, the values of almost all the Territory's agricultural products suffered a serious decline. The total value of the chief agricultural export products was £2,816,225 as compared to £4,107,139 in the previous year; the average value was £17/17 per ton in 1938 as compared to £23/16/6d. in 1937. Yet, although we have to go back to the year 1934 for a lower average value (£16/10/6d.), we are still well above the rock-bottom figure of £14/16 per ton for the year 1931, a year which focussed attention on the slow rate of progress of development and the imperative need for increasing the production and circulation of wealth in Tanganyika. In the same way, the recession suffered in 1938 repeats the warning that there must be an economic basis for the administration of the Territory and that the social and moral welfare of the inhabitants primarily depend on export crops for the time being.

Commodity prices throughout the world were very sensitive to the disturbed political conditions and markets were further restricted by war and trade barriers. Even so the trend of values of several products has been unusually puzzling. A year ago there appeared to be but little hope of a rise in the price of coffee which has, however, shown an appreciable and welcome advance for the better qualities. It seemed impossible for the price of cotton to be much lower but additional falls in value occurred from week to week and the future for this important commodity is most uncertain. The price of groundnuts and copra fell by thirty per cent below the previous year's values. Sisal has presented the anomaly of an unprofitable price yet no abundance of world stocks and depression in this basic planting industry is felt throughout the Territory. Withal the Mandated Territory suffered additionally by the uncertainties which world propaganda and events have centred on Tanganyika. The stability of non-native enterprise and the equilibrium of peasant agriculture were submitted to severe strain by the economic and political uncertainties.

It might have appeared that such a time was inopportune for Government to appeal for accelerated development and the engagement of all races in some form of productive work and increased crop output to offset the serious effects of the low prices for all primary products. But the response to the call which was made in the latter part of the year was immediate and the readiness and spirit in which the peasant cultivator has reacted to the guidance and instructions regarding crop planting and the use of land is both a tribute to those responsible for the administration of the tribes and a good augury for the future. Perusal of the district reports of agricultural officers gives a buoyant feeling that in almost every part of the Territory we are on the verge of

a period of more rapid progress; this is the result of a decade of patient propaganda and work, of experimentation and demonstration.

DEVELOPMENT POLICY

It would appear from time to time that there is a good deal of misconception regarding the need for development of African lands. Also, fear is expressed that "plant-more-crops campaigns" and settlement policies imply an inexcusable exploitation of the African and the soil. Some would even have it that the sole aim of development and increased production of crops is the pecuniary gain accruing to Government therefrom. This is not so; the problems of African development, the obstacles to be overcome and the disappointments experienced, are so great that only the highest motives could sustain the patient perseverance of the administrative and technical officers in their endeavours to improve the lot of the African people.

The motive for increasing individual wealth is such as is found to be the guiding force in most civilized countries to-day, namely, to raise the standard of living of the inhabitants. The International Labour Office has described "standard of living" in objective terms as "consisting of three main elements: (1) the level of consumption or the composite of goods and services of a specific quantity and quality consumed by an individual, family or group within a given period; (2) social services and free services particularly relating to health, education and recreation; and (3) working conditions which affect the worker's health and earning capacity and the size and regularity of his income." At heart such are the sentiments not only of those responsible for the administration and guidance of the Territory's native peoples, but also many of those of alien race who have made their homes in Tanganyika or are engaged in plantation enterprise or commerce. It is abundantly clear that for some years the moral and material welfare of both natives and non-natives is dependent on an increase in the export of economic crops; to-day the alternative would be drastically to reduce social services and to leave the African peasant in what has been aptly described as a state of picturesque antiquity.

Over a great part of the Territory there should be little if any danger of unbridled exploitation of the soil from any campaign for the increased production of crops. Taking the Morogoro district of some four million and a half acres in extent as an example, if every family planted but half an acre of cotton, representing about fifteen man-days' work, this would entail the utilization of only twenty-four thousand acres of land, yet current output of cotton would be trebled. It is only in the Lake Province, where there is a pressure of population and the soil is basically poor, that the land has suffered any visible drain of fertility through over-cropping; this has not proved to be entirely detrimental for it has accelerated the adoption of more intensive yet simple farming methods, such as the use of cattle manure and of crop residues, of green-manuring and planting at the optimum time. There is no doubt that progress on mixed farming lines will lead to increased crop output with ultimate improvement in soil fertility. It is in the sparsely populated areas, especially where there are no economic crops, that we get improvidence in the use of land, together with forest and soil destruction and a bare subsistence level of living for the cultivator.

When the standards of living of the comparatively hard-working tribes are compared with those who produce little or nothing of economic value, it is

evident that the financial stability of the Territory can be placed in a position which would permit of considerable expansion of the social services.

During the investigations of the Labour Commission the question of the effect on labour supplies of the encouragement of the peasant cultivator and the increased production of export crops by natives was considered. An analysis of the figures given in the Commission's report, published during the year under review, of wage earners in employment and of those engaged in the production of crops for sale, indicates that there are about half a million able-bodied adult males who are not engaged in productive work; many of them contribute little or nothing to the welfare of the tribe or the maintenance of territorial services. The report concludes that: "There is ample manpower for the needs of the Territory, but that from one cause or another there is labour wastage among the wage-earners, that those engaged in the production of native-grown crops are in many areas working at low pressure and that the young males in certain areas are not taking their proper place in the life of the people as they must live it in a competitive world and in the face of influences from which they cannot for ever be protected." The Commission also recorded the view that it "could see no reason why Government should not press on with its schemes for the improvement of economic production of native-grown crops for the consequent elimination of wasteful use of land."

The policy of Government in regard to peasant agriculture was stated in Legislative Council as aimed to encourage and assist the African to make the most efficient use of his own resources for the purpose of crop production, bearing in mind the necessity of maintaining the balance between peasant and plantation agriculture. In this respect close touch has been maintained with the representatives of the plantation and mining industries, who have given the department valuable support. In connection with non-native enterprise it was declared that: "The present and future policy of Government was to give all possible encouragement and assistance to non-native settlement, provided there is sound reason for believing that it will assist in the task of promoting the prosperity and well-being of the community." Furthermore, "Non-native settlement is not to be regarded as inimical to the interests of the native population; on the contrary it is an integral part of the policy whereby Government plans to advance the general prosperity of the country." The value of settlement in raising the standard of living of the indigenous population can be very marked and is amply demonstrated in the vicinity of existing European settlements.

Towards the end of the year a development committee was appointed to examine and report to Government on the methods whereby the development of the Territory by both non-native and native enterprise might be encouraged and assisted and also to advise on the extent to which development might be accelerated by works of public utility undertaken by Government.

NON-NATIVE FARMING AND PLANTATION ENTERPRISE

The year was a very difficult one for the non-native farmer in East Africa. But it is important to remember that this is true of agriculture throughout the world, including those industrial countries and territories rich in minerals that have been able to subsidize their agricultural producers. A purely economic analysis of the position of the primary producer is misleading, and it becomes necessary to assess the moral as well as the material value of farmers and farming to a community. For example, in this Territory, the African would

not have progressed as far as he has but for the precept and example of non-native enterprise; the European has also pioneered several crops such as coffee, tobacco and cotton which now form important native industries.

Some of the earlier pioneers have gone, others find the burden of high interest charges incurred during the boom year an insuperable obstacle to the correction of early mistakes or the adoption of new methods. The need for soil conservation is understood and anti-erosion methods are commonly seen. The old idea of concentrating on one crop has disappeared and, where water supplies are adequate, there is a desire to follow mixed farming methods. The ultimate establishment of mixed farming in European areas is inevitable, but progress will depend on reasonably cheap finance together with the application of anti-pest and disease measures and the improvement of the breeds of stock, while technical demonstration and guidance will be essential.

Expansion of the internal market and a monthly cash income would be necessary to any wide extension of non-native farming, and here, as with tea, sugar and tobacco, the native market is of first importance. But the extent of native consumption will depend almost entirely on the income derived from the export of cash crops. Thus the development of an internal market for agricultural products and the welfare of the non-native mixed farmer will largely depend on an increase in the production of export crops by natives and the development which will follow, such as, an increased number of trading and processing establishments, improved means of transport, better roads, and so on.

A second generation of Europeans is now coming on having an unrivalled knowledge of the African and local experience which should be regarded as a valuable territorial asset. There are also many Indians born in East Africa whose livelihood must be derived from the land, for it is unlikely that all will find opportunity to engage in trade. Vocational training establishments will be required for the youth of both races if they are to take their proper place in the territorial economy.

In addition to the leading place taken by Indian enterprise in large plantation projects there are a number of small men successfully engaged in farming, vegetable and fruit growing on the Central Line. There is room for expansion of such activities.

While the international restriction schemes for tea and sugar have placed the individual producer on a more stable basis, they have somewhat retarded the development of the comparatively recently alienated lands of the Territory.

A survey of potential sisal areas was carried out by a party consisting of an administrative officer and an agricultural officer together with representatives of the sisal industry. It was ascertained that the area of land suitable for sisal production is not so extensive as was believed, and since the survey was initiated it appears that any further large extension of planting may be inimical to the sisal industry. A map and index of all sisal estates has been prepared.

A great deal of interest has been shown in pyrethrum and an initial survey of some eight thousand acres of land in the Southern Highlands was carried out, of which much was found to be suitable to this crop.

Non-native producers of such crops as sisal, coffee, tea, maize and wheat, and those engaged in dairy farming, are now well organized in territorial associations. The membership includes several nationalities. Politics are barred and the sole object is to promote the welfare of the respective industries. Statutory boards exist for sisal, coffee, cotton and tea which act as the liaison

between the industries and Government, and a further board is contemplated for the pyrethrum industry. Cooperation is maintained with neighbouring territories by means of standing committees of producers of sisal and coffee. An inter-territorial committee of coffee traders and the African Tea Association exist to coordinate the interests of the East African dependencies, while meetings of the sugar and wheat interests in these territories are held from time to time.

NATIVE DEVELOPMENT

It was stated in the report for the year 1937 that "the peasant cultivators of the Lake and Western Provinces especially must regard cattle manure as of paramount importance to their crop husbandry," also that "there may occur seasons of inadequate rains when cash and food crops will be poor; but this should not cause uneasiness since the attainment of the desired objective will merely be accelerated." The 1938 season proved that these statements were only too well founded, for in the drought-stricken areas practically the only normal crops harvested were by those peasants who had followed the department's propaganda for the use of cattle manure; the manured crops were outstanding and caused both comment and envy. The opportunity of driving the lesson home was not lost and, as a result of an intensive effort on the part of the administrative and agricultural staff, the use of manure became a common practice by the end of the year. In the Western Province over thirty-five thousand cultivators have manured their lands for the coming planting season, in Kwimba the number is twenty thousand families with another seventy thousand or so using household refuse. Other districts report up to half the population as converts, and in Shinyanga some chiefs were so impressed by the fact that crops on manured land suffered less from drought than crops not so treated, that they issued a native authority order for the application to the land of farmyard manure as an *anti-famine measure*.

The success of the manuring campaign is the most important step that could be reported in the progress of native agriculture. When the African people as a whole appreciate the importance and value of humus to crop production and the maintenance of stock, then will public opinion be more ready to insist on a closer control of bush fires and crop and animal residues will be utilized instead of destroyed as now commonly happens. The spectre of famine should then largely disappear and the export of cash crops will be increased, while soil fertility should be maintained.

In connection with this work the use of pack-oxen was started; over three hundred cattle were trained to the pack at Lubaga and others at the Mwanhala and Tumbi agricultural development centres. The method appeals to the African because the cattle are available and the packs can be made at very little cost from bush materials; no expensive carts have to be bought, roads are not necessary and the pack-oxen are able to traverse the narrow tracks between fields without annoyance to the other cultivators. In addition to the transport of manure to the fields, the trained oxen take crop-stover to the homestead and are available for carrying produce to market. Also the dangers of erosion which attend the use of the wheel and the sled are avoided.

Water is essential to agricultural development, yet very little has been done to conserve water or to economize in its use. Under the newly-formed Water Executive the problems of irrigation on Kilimanjaro are being investigated. But it is in the Lake Province again that we find the native determined

to carry out measures for himself and several large earth tanks and dams for water storage have been built entirely by voluntary tribal effort.

Over four hundred ploughs were purchased by Africans in Musoma, of which more than ninety per cent were of foreign make costing forty shillings complete with chains and yoke, as compared with sixty shillings for a British make. The use of the plough is not encouraged for the purpose of cultivating more and more land as this leads to soil-mining and the ultimate ruination of large areas; ploughing is advocated merely to give the cultivator more time which can be utilized for the care and management of stock, the collection of crop-stover and its return to the land as pen manure.

PEASANT HOLDINGS AND SETTLEMENT

Individual peasant holdings were first demonstrated in Tanganyika in the year 1933. A holding represented an economic and compact unit of land with improved house and cattle homestead. The object was to demonstrate that, by crop rotations and the use of cattle manure, a unit of land sufficient to maintain a family could be permanently cultivated with soil-fertility unimpaired, if not increased. The experiment and demonstrations had wider effect than first contemplated, as they have brought into prominence the potential output of the peasant farmer: at Kingolwira the cash income with last year's low prices averaged two hundred shillings per peasant holder including one ton of seed cotton, compared to the shifting cultivator's average income of twenty shillings or output of one hundredweight. At Nyamahona the average cash income was ninety-three shillings. The problems of settlement of the surplus population of the Uluguru Mountains and Kilimanjaro are now matters of some urgency and in the Morogoro district many natives are paying five shillings and more per hectare to missions and other landowners for land in the foothills; there is ample room for expansion in the plains. Immigration from the old lands of Mwanza across Smith Sound to Uzinza increases year by year.

Following the tour to Nigeria of Mr J. G. M. King, Agricultural Officer, which was made, with the assistance of the Carnegie Fund, to investigate the conditions and progress of mixed farming and peasant holdings in Nigeria, an investigation of land utilization by Mr D. W. Malcolm, Administrative Officer, and the experience already gained at the several settlement centres, it is now possible to lay down the best lines of approach for the extension of mixed farming to peasant agriculture and organized settlement, having regard to the varying conditions to be found over such a vast country.

The conditions of the densely cultivated Sukuma cattle country are entirely different from the tsetse and the tick-infested heavily-wooded savanna bush of the Eastern Province. Thus the necessity for clearing the tsetse bush and the provision of cattle dips dictate the form of lay-out of the Kingolwira settlement on lines which tend towards individual rather than communal occupation of the land. Here the objective is to provide a demonstration block of fifty to a hundred advanced peasant holders, who are encouraged to adopt as early as possible *all* the improved methods of mixed farming. It is, however, obvious that the amount of supervision and skill required is so great that any attempt at a general extension of the complete system may be unwise if not impracticable. At the same time it has now been amply demonstrated that people can be settled on the land adjoining the demonstration block in such a manner that they can sooner or later absorb the lessons of the established mixed farmers.

On the other hand, in the strongly tribalized Sukuma country, it was found that the chiefs could not look with favour on the lay-out of ideal peasant holdings, which to them savoured of breaking into their preserve and affecting their traditions and authority, especially in regard to the allocation of land. Furthermore, the conditions of the cultivated steppe do not call for such organized settlement as initiated at Kingolwira. Hence, in the Lake and Western Provinces, it was decided to extend the principles of mixed farming one step at a time by the mass approach method through traditional channels of authority. The support of the chiefs was thus quickly secured with the result that some one hundred thousand cattle-owning natives are utilizing cattle manure for crop production. This is regarded as the essential first step to a static system of agriculture.

With all peasant settlements it is desirable for the chiefs to select the land for settlement and essential that they allocate the holdings.

The problems of native land tenure are as controversial as they are important to organized settlement and it would be just as wrong to hold that tribal ownership of land should under no circumstances be permitted to give way to individualism, as to consider that only by the individual's ownership of the land can sound agricultural progress be achieved. Government has directed special attention to this vital subject. The crux is that rights of sale of land by the individual is invariably a prelude to agricultural indebtedness, and that the tribal fabric may be undermined by individualism.

RAILWAYS

The railway provides an essential service to development, and the General Manager and his staff maintain close contact with the department. There have been many discussions as to the assistance which the Railway Administration can give. But the continued difficult financial position of the Railways and Ports Services rendered any considerable reduction in freight charges impossible. However, applications for relief were sympathetically considered and various concessions were granted. The rate on groundnuts for export was temporarily reduced by two shillings a ton to thirty-five shillings. The cotton industry was given some small relief by a temporary reduction on the port charges for cotton seed and the crop was encouraged in the Kinyangiri area by the quotation of a low rate for unginned cotton to Kilosa and Ruvu until the volume of production should warrant the erection of a ginnery on the branch line. The copra industry on the coast was assisted by a reduction on the port charges on copra imported by coasting vessels. It was not possible to make any reduction on the railway and port rates on sisal but the Railway Administration continued to allow at Tanga a longer free storage period for sisal than for other commodities. Throughout the year Bukoba coffee enjoyed a thirty per cent reduction in rail freights to the coast while a reduction of fifteen per cent was made from other points. To assist in the easier movement of estate labour the T.R.S. *Liamba* was altered slightly to carry more native passengers and an offer made to run additional voyages at low rates. To meet a demand for cheaper and better meat for labour on the Tanga Line cheap rates for cattle have been introduced to operate from the 1st January 1939.

There is, however, no doubt in my mind that reductions, at least on the rail rates for native-grown export crops, are unlikely to effect any increase in production, even where they are passed on to the peasant, for the simple reason that the amount concerned is usually given on a falling market, and

the market fluctuations overshadow the reductions in freight; for example, if cotton lint were railed from Morogoro to Dar es Salaam free of charge this would permit of only one cent extra being paid to the producer per kilogram of seed-cotton, whereas during the last three or four seasons the price has dropped from one to four cents and more within a few weeks. Administrative action, propaganda, and the application of improved agricultural methods can more than offset a slump in price within a planting season.

On the other hand where imported goods, agricultural implements, and building materials can be cheapened, small concessions are invariably passed on to the buyer and the habit of spending is thus encouraged, which aids the objective of raising the peasants' standard of living.

MARKETING

There is much of moment to report. The members of the sisal associations of Tanganyika and Kenya and the London Committee have given the most searching attention to the position of the sisal market and legislation has been enacted providing for the registration of estate marks and compulsory grading; local and world statistics are being collected. With coffee, whereas the inter-territorial meetings have done much to clear the air, there are still difficulties in the way of a federation of the producer interests of Eastern and Central Africa. It must be remembered that there is a super-abundance of sectional, national and racial interests in the coffee industry, and a certain amount of parochial pride, which are obstacles to effective cooperation for the elimination of unnecessary costs (such as has been achieved by the amalgamation of the coffee mills in East Africa in agreement with the Moshi mill) and, what is equally important, to the avoidance of excessive competition by producers which often occurs with unorganized marketing. The Tanganyika Coffee Growers' Association has done much in the way of making cooperative sales for the benefit of members, and steps have been taken for the independent European coffee planters cooperative society to be absorbed by the Association. Consideration is being given to a centralization scheme for sales of tea throughout East Africa, but the growers of the Southern Highlands find it difficult to accept the suggestion for a common trade mark for local use.

The Pyrethrum Growers' Association of the Southern Highlands appointed the Kenya Farmers' Cooperative Association as their sole selling agent, mainly in order to attain uniformity and cooperation with the Kenya Pyrethrum Board.

The wheat growers of the Northern Province are considering the desirability of joining an East African wheat pool and the maize growers have continued to market through the Kenya Farmers' Cooperative Association. The fruit growers of the Southern Highlands have formed an organization to standardize and sell their produce; similarly with papain in the Northern Province. In fact the non-native producer is not to be beaten by the difficult and uncertain times, rather is he more determined than ever to leave nothing to chance. Under such circumstances the producer knows no administrative or political borders.

With cotton, the marketing system of the Lake Province has continued to work smoothly despite the fact that all but one or two of the so-called middlemen have failed to operate as such; they are now nothing but ginners' agents. In the Morogoro and Kilosa districts an investigation into cotton marketing was carried out by Mr W. S. Marchant, O.B.E., Deputy Provincial

Commissioner, and his report is still under consideration. The middlemen in these areas again acted as ginners' agents, but at most of the markets where there were several store plots only one buyer operated. Nevertheless, every middleman drew commission from the ginners at the rate of one cent and a half per kilogram of raw cotton or some ten per cent of its value on *all* cotton purchased at ginneries and other posts throughout the district as well as on the cotton purchased at the open markets. Actually the middlemen purchased less than 370 tons of seed-cotton in the Morogoro district but received the sum of Shs 30,498 as commission, that is, at the rate of eight cents and a half per kilogram.

FOOD CROPS AND NUTRITION

In evaluating the standard of living the first test is the physical health of the people concerned. It is accepted as axiomatic that the more varied and plentiful the supplies of food the greater is the likelihood that the diet will be balanced, and will contain all accessory food factors. But it would be premature to talk of vitamins and the like in the several areas where periodic famines occur.

The anti-famine policy is simple, consisting of insistence on the planting of such root crops as cassava and sweet potatoes; but all too frequently these food reserves are not maintained as they should be and the produce is often dug up and sold during the years of plenty. It is essential to establish such living foodstores in a year of good rainfall. The constant menace of locusts also should render the planting of subterranean food crops a matter of routine.

The effect of good farming practice on the quantity and quality of grain and vegetables cannot be overstressed.

The value of export crops to an improved dietary is very considerable. It is known that more animal proteins could be incorporated into native diet with advantage and it is where cash circulates freely as in the Tanga district and on Kilimanjaro that this occurs. Further, there are many areas where, for reasons of soil and climate, many desirable food-stuffs cannot be grown, for example, coconuts, palm oil, groundnuts, citrus fruits and vegetables. The possession of cash resources by natives and cheap transport are of assistance in assuring the interchange of such commodities.

Investigational work on the important food crops is divided amongst the different experiment stations; work on cassava and sweet potatoes and sorghums suitable for coastal areas at Morogoro; rice for coastal areas at Zombe, Rufiji district; sorghums and rice for the Lake and Western Provinces at Ukiriguru; groundnuts at Lubaga; temperate food crops at Itheme, Iringa; beans at Lyamungu, Moshi district. In addition, trials of different pulses and maize are conducted on all stations as well as trials concerning the inter-planting of food crops, their spacing and time of sowing. Soya beans have been tried in several areas but without success. Encouragement is given to the cultivation of oil palms especially in the Luichi valley near Kigoma.

An essential part of all work connected with native food crops over the last eight years has been the surveys which have been made of the local varieties of food crops grown and their collection and trial under standard conditions. The result is that we have an accurate knowledge of the potentialities of a large number of different local varieties of rice, sorghum, groundnuts, maize, sweet potatoes and cassava. The characteristics of these varieties have been recorded and, after eliminating unthrifty varieties, the high yielding types, and particularly types with a short growing period, are multiplied for distribution.

Introduced varieties are tested against the local selections before multiplication and distribution.

Work on the virus diseases of cassava is carried out at Morogoro in cooperation with the Plant Pathologist, Amani; the problem of the parasitic weed, *Striga hermonthica*, in grain lands in the western areas of the Territory is under investigation at Ukinguru, latterly in cooperation with the Botanical Department of Victoria University, Manchester; and at Ukinguru also control measures are sought by a modification of methods of cultivation. Diseases of beans are under investigation by the Plant Pathologist at Iyamungu and during the year a large number of varieties reputed to be resistant or immune to bacterial blight diseases were introduced for trial.

This department is indebted to the Department of Agriculture, Kenya Colony, for the services of Mr R. J. Lathbury, Plant Breeder, who visited the wheat growing areas of the Southern Highlands and Arusha district. Valuable advice was given regarding yields, varieties and methods of cultivation and also regarding the different tester wheats which should be grown to determine the strains of stem rust disease which are present.

Large quantities of buckwheat were distributed to natives in Iringa district. This crop tolerates acid soils well and it may thus be used in place of eleusine, a crop which is responsible for much destruction of forest since it is the practice to burn down forest to provide ash for neutralizing the soil acidity. Buckwheat is well liked by the African who has already found a method of brewing beer from it; an important consideration if it is to replace eleusine.

In the efforts which are being made to further an increase in the production and consumption of fruit, the nurseries at Morogoro and on the Sisal Station were extended, more especially for the propagation of budded citrus trees and mangoes. The trees are sold at a nominal price. Deciduous temperate fruits and vines are being propagated at the Iheme Agricultural Experiment Station, Iringa.

In any campaign for improved nutrition it is found that the average African is just as conservative over his food as is the European. The women invariably undertake a very large proportion of the work of growing the food and are entirely responsible for cooking it and it is therefore to them, as well as to the men, that the appeal must be addressed for improved nutrition. It is more difficult to persuade the womenfolk to cook and eat strange food-stuffs than it is to get the menfolk to grow the new crops; more education is required.

Rice should be one of the most important food-stuffs in the Territory, as crops are obtainable from swamp-lands and by irrigation when other dry-land grain crops fail in years of drought, but the local price is so high that it is regarded solely as a cash crop and, despite the shortage of food-stuffs this year, 8,196 were exported to neighbouring territories. This crop is protected to the extent of four shillings per hundred pounds duty under the Customs Tariff, plus a suspended duty of two shillings per hundred pounds.

ANIMAL HUSBANDRY

In the annual report for 1937 it was recorded that "the department is concerned mainly with linking more closely the *management* of cattle with the cultivation of the soil." In other words, cattle should be regarded as a means of keeping the land in good condition by increasing soil fertility, rather than that the land be exploited and ruined in a vain effort to feed

roaming herds of cattle. The notion that "the land is made for man" is a dangerous one for an improvident and uneducated race, especially where ownership of livestock is almost the sole ambition of mankind. But as shown throughout this report the real value of cattle is being realized more and more by the technical staff, the planter and the peasant alike.

There can be no question of the future position of cattle in the local farming systems, but we still have much to learn regarding stock management and valuable experience is being acquired on all the experiment stations where cattle are kept. These stations, however, are primarily concerned with native agriculture and, to influence the extension of mixed farming to non-native plantations, it is considered essential, in the Northern Province, to establish a centre for investigating and demonstrating the possibilities of stock, including sheep, pigs and poultry.

There is great scope for improving native poultry which are extremely poor and in many areas very scarce. Peasants are anxious to obtain pure-bred cockerels and many have been supplied from small pens kept on experiment stations. Arrangements have been made to increase the supply of birds for distribution, but to prevent the dissipation of the introduced strains it will be necessary to eliminate native cockerels. Facilities are required for protective vaccination against the two main diseases, fowl typhoid and fowl pox.

SOIL CONSERVATION

A large proportion of the time of departmental staff is devoted to the extension of the application of methods of soil protection in the form of contour ridging, the planting of contour hedges and windbreaks, the demarcation and protection of exposed hilltops, steep slopes, river sources and river banks and the amelioration of soil conditions by manuring, and the communal planting of trees. An outstanding problem is the provision of water supplies at the periphery of over-populated and over-stocked areas to allow of a more even distribution of settlement and alternative grazing grounds for stock. A number of districts, which had not already done so, have adopted simple soil conservation rules.

The rapid regeneration of bush which has followed the protection given to hill slopes in parts of the Lake and Eastern Provinces has given harbourage to game and such vermin as porcupine which have been the cause of serious damage to crops. This problem will need attention if anti-soil erosion measures are not to be opposed by the owners of the crops despoiled by game.

The greater part of the Territory's agriculturists are gradually becoming soil conscious; the main limiting factor is the low standard of education of the native authorities and the paucity of technical staff, especially of well-educated Africans who have received a sound agricultural training.

While it has been amply proved time and again that progress in anti-erosion or soil conservation measures can achieve no degree of permanency without a preliminary period of patient and painstaking demonstration and education, it is equally obvious in several instances that educative measures alone would be so slow that the process of land ruination would be complete before the population were able to realize the necessity for ameliorative measures. It is a race against time. Generally speaking the chiefs and the more intelligent of the peasant cultivators can be persuaded of the menace of soil erosion and the immeasurable benefits of soil conservation. Simple native authority orders are effective for the majority of the cultivators willingly

to follow the demonstration laid down by technical staff and the more progressive cultivators; ultimately it is feasible to coerce a defaulting minority into line by legislative means. The task is easiest where an export crop is most widely cultivated. There is little or no interest in agricultural practice where a tribe is solely on a subsistence basis, as, for example, in remote parts of the Southern Highlands and in the Uluguru Mountains. It is in such areas as well as in others where certain chiefs have disposed of virgin lands without due precautions that the most serious forms of forest and soil destruction are to be found. With such semi-pastoral areas as the Central Province little or no progress can be achieved until the native authorities realize that grass and pasture land requires as much care as the cultivation of food or cash crops.

Further details of progress during the year 1938 will be found in Section II of this report.

AGRICULTURAL EDUCATION

The chief limiting factor to the development of the agricultural resources of the Territory is education. The peasant cultivator is illiterate, while the older chiefs and the leaders of the local authorities and many of the African agricultural instructors have little or no educational background. To-day it is difficult to obtain youths of a sufficient standard of education for agricultural training; we are, in fact, now paying for the enforced economies of several years ago when, owing to the fall in commodity prices, the majority of Africans lost heart and temporarily gave up the cultivation of export crops and so jeopardized the services which had been laboriously built up solely for their benefit.

With the assistance of financial contributions from the native authorities of the Lake Province facilities have been provided for the training at Ukiriguru of a better type of African instructor. A scheme was also revived for an agricultural training institute to be sited at Kingolwira. The African instructor staff attend refresher courses at the several experiment stations, but the lack of a sound early training is a great handicap.

Fifty-one pupils were in residence at the Nyakato agricultural training centre. Far greater interest in the centre was taken by the chiefs and people of Bukoba, who somewhat resented the closing down several years ago of the former Nyakato Central School. Owing to peculiar soil and other local conditions it has been impossible to utilize the centre for the education of agricultural instructors from districts outside Bukoba. Evening classes for adults were held at Nyakato.

In regard to the adult school at Lubaga, Chief Wamba and Chief Makwaia pointed out that early manhood is too preoccupied with tribal rites to be concerned with agricultural training. The school has therefore been rearranged on the lines of an indigenous village school for both sexes. The pupils will be housed, boys and girls apart, in improved "khayas" or native homesteads under the care of married couples and they will receive simple instruction in agriculture based solely on indigenous methods. The experiment will be followed with interest.

Year by year, agricultural experiment stations have grown into mixed farms and centres of rural development of much educational value, and there is now a tendency to site native authority schools in the vicinity of such stations, for example, the agricultural development centre of Mwanhala and the new provincial native authority school built there during the year is likely

to have a profound influence on the life of the people of the Western Province.

On the initiative of the Officer Commanding the Sixth Battalion, the King's African Rifles, a scheme was prepared whereby askaris, during the last six months of their army service, can proceed to one or other of the agricultural centres for practical agricultural training, especially in regard to mixed farming and peasant holdings. Six askaris are now at Lubaga and one at Kingolwira; two other men of non-commissioned rank have elected to settle at Kingolwira.

Kingolwira Prison Camp.—The prison camp was fully described in the last report. It owes its establishment to Mr G. H. Heaton, Commissioner of Prisons (now of Kenya), who enthusiastically supported the plan to give long-term prisoners a thorough training in agriculture during the period of their sentence in order that, on release, they would be in a position to lead an honest and useful life and have adequate means of support. The prisoners may elect to settle at Kingolwira on release and the other settlers have no objection to their doing so. Those of good behaviour and who make good progress are allowed to leave the prison daily on parole to start development of the holdings they wish to occupy when they are free.

The prison is being extended to accommodate three hundred men at a cost of only £1,000. All building and development work is carried out by the prisoners themselves under the instruction of Mr G. H. Foster, Agricultural Assistant. An industrial shop is being built. In short the prison will soon become the most important vocational training centre in the Territory. The work is invigorating to all those concerned with it.

PESTS AND DISEASES

An invasion of migratory locusts (*Locusta migratoria migratorioides*) occurred in October in Musoma, travelling south from Kenya, and, after passing through Shinyanga and along the Mwanza-Kahama border westwards, was lost sight of in the Emin Pasha Gulf. Egg-laying took place but was easily dealt with by hoeing up egg masses and beating hoppers as they hatched. A large swarm also passed through the Kasulu Highlands towards the end of the year. No damage to crops by either flying locusts or hoppers was reported. Small hopper bands of the red locust (*Nomadacris septemfasciata*) were cleared up in the Bugufi district early in the year. The policy is to attack all accessible hopper bands and to take all precautions to protect standing crops from any form of locust damage.

The incidence of pink bollworm in cotton, reported last year for the first time in this area, was severe in the Musoma-Ukerewe area of the Lake Province and was found occasionally in the Sukuma and Uzinza areas. However, it is considered that the early planting of cotton will more than offset the damage caused by this pest. Special measures were taken to ensure thorough uprooting and burning of all cotton residues at the end of the season. Otherwise cotton pests were little in evidence.

Regular spraying of coffee against *Antestia* on Kilimanjaro has given place to spraying only when the pest population warrants such a measure, indicated by the check spraying of random trees, as demonstrated by the Entomologist. A severe outbreak of *Hemileia* leaf disease in coffee in the Southern Highlands caused considerable damage which spraying did little to relieve. The importance to growers of having a detailed knowledge of climatic and growth conditions within plantations and of the progress of the disease throughout the year over a number of years is stressed by the Plant Pathologist,

Details of the chief export crops for the past four years are given in the following table :—

PRODUCT	Maximum Output for Export prior to 1938	1935		1936		1937		1938	
		Amount	Value per ton f.o.b.	Amount	Value per ton f.o.b.	Amount	Total Value	Amount	Total Value
Year	Tons	Tons	£ s	Tons	£ s	Tons	£	Tons	£
Sisal	90,632	52,676	13 14 ³ / ₄	80,559	23 7	90,632	2,079,204	*101,400	1,426,192
" (manufactured) ...	2,325	2,048	25 8 ¹ / ₂	2,325	32 13	526	17,023	8	260
Cotton lint	11,520	9,980	57 1	11,274	56 16 ¹ / ₂	11,520	603,594	8,871	380,304
Coffee	18,588	18,588	26 4	12,146	28 4 ¹ / ₂	13,612	439,501	13,750	385,576
Groundnuts	22,788	16,429	12 16	22,788	12 3 ¹ / ₂	22,251	257,807	3,579	31,198
Hides and skins	4,210	3,131	48 18	3,094	51 19 ¹ / ₂	4,210	300,695	*3,720	202,396
Copra	9,318	4,050	9 9	7,458	11 0 ¹ / ₂	7,522	104,757	4,004	32,090
Sesame	4,811	4,127	10 11	4,745	11 19	4,605	55,939	*5,241	53,317
Rice	8,857	4,924	13 12	6,513	11 5 ¹ / ₂	8,857	90,652	8,196	90,960
Millet and mtama	7,732	3,597	4 5	3,539	4 2 ¹ / ₂	4,187	18,491	1,817	9,027
Maize	2,901	1,434	2 10	1,368	2 9	1,441	6,574	279	1,078
Beeswax	738	531	87 2	524	99 6 ¹ / ₂	738	81,658	686	55,153
Tea	98	9 ¹ / ₂	124 6 ¹ / ₂	37 ¹ / ₂	130 10 ¹ / ₂	98	13,486	*141	19,306
Sugar	3,442	—	—	3,442	9 1	3,099	30,616	*4,032	40,375
Gums (Copal and Arabic) ...	1,124	848	20 10	475	27 17	886	25,877	*1,274	29,392
Ghee	713	607	40 6	713	47 17 ¹ / ₂	710	51,265	*847	60,601
Total	189,795	152,979 ¹ / ₄	18 14 ¹ / ₂	160,998 ³ / ₄	23 10	174,894	4,167,139	157,825	2,816,225
									17 17

*New highest export tonnages.

†Includes 2,963 tons of hides and 1,149,814 skins weighing at approximately 1,500 per ton.

in order to give the planter an idea of the future course of an outbreak of the disease and enable him to plan accordingly. Leaf miner continues to be one of the major pests on Kilimanjaro for which there are as yet no reliable means of control. The problem is being investigated both at Amani and the Coffee Research Station. The incidence of the coffee berry borer (*Stephanoderes hampei*) in Bukoba and the coffee stem borer (*Anthores leuconotus*) on Kilimanjaro is kept under control by the routine campaigns which were carried out with the usual thoroughness and with benefit to the quantity and quality of the crops produced in these areas. A collection of parasites of the mealy bug (*Pseudococcus kenya*) was made by an Entomologist from Kenya in Bukoba where the pest is fully controlled by these parasites; outbreaks of any severity occur only infrequently on Robusta trees in the drier areas.

Severe damage was caused to the Northern Province maize crop by the leaf-folding caterpillar (*Mirasmia trapezalis*). Measures for the control of maize stalk borer by means of instituting a close season has been the subject of discussion with the industry.

The sisal weevil (*Scyphophorus acupunctatus*) caused no unusually severe damage in the Tanga Province; the prompt measures taken last year to ensure the destruction of all sisal weevils, inadvertently introduced into the Northern Province and Central Line sisal areas, were effective. The coconut beetle (*Oryctes monoceros*) continues to take toll of the coconut plantations. A severe outbreak of stem rust (*Puccinia graminis*) in wheat occurred in the Southern Highlands and the K4 strain of this disease made its appearance for the first time, causing much damage to the crop. In the Northern Province the three strains of rust known to be present caused little or no damage.

Vermin, particularly baboon, pig and rodents, continues to take a heavy toll of crops; pig being especially destructive to cassava and sisal. Considerable damage was done by game to native cultivations in the Ulanga district, while elephant are a menace to native development in the Bagamoyo district, and rhinoceros are a pest in the Pares.

The annual report of the Entomologist, Morogoro, is published separately as Entomological Leaflet No. 17. Details of the work of the Plant Pathologist and the Entomologist stationed at Lyamungu will be included in the annual report for the Coffee Research Station.

NOTES ON THE CHIEF EXPORT CROPS

Sisal.—Sisal continues to be the most important export of Tanganyika. Moreover, from being at one time the least important of the main producing countries the Territory now commands first place among the sisal producing areas of the world. The industry has been built up in Tanganyika by great and persistent enterprise and sisal is now well established as one of the world's main primary commodities. The country's economic structure is dependent upon it to a very large degree, especially as the amount paid by the industry in wages is a considerable item in its costs of production.

The growth and production of sisal is not materially affected by the vagaries of the weather and during the year the export of this crop reached the record amount of 101,400 tons compared with 90,632 tons in 1937: the gross value, however, declined heavily from £2,079,204 in 1937 to £1,425,192. The c.i.f. value of all qualities was £22/18/9d. per ton for the year 1937, but in the year 1938 the average fell to £14/1/0. Thus although the total volume of exports showed an increase of 12 per cent above the previous year, the gross

values fell by 31 per cent. Not only was the price level below the cost of production, but the reflection of previous periods of depression when diminution of capital expenditure was inevitable, has resulted in more difficult field conditions in terms of length and quality of leaf, with the result that during the year the percentage of higher grade fibre declined.

Unlike the cultivation of annual crops, sisal production must be planned a long way ahead, and much of the expenditure in any year cannot be recovered until some years later, when conditions affecting production, demand, and world markets may have altered substantially. The large-scale expenditure necessary both in the field and on factory machinery, and the long-term period of years over which the operations and expenditure are spread before a return is obtainable, involve additional risks. Moreover, East African sisal has serious competitors, especially in the East where supplies of efficient labour are readily available at a cheaper rate of pay than is the case in this Territory. This is a point which cannot be ignored in times of economic stress.

It is of the greatest importance that measures should be adopted to assure more stable economic conditions for the industry. By means of the export tax of two shillings per ton the industry provides funds under the administration of the Sisal Board for research, and to this work the Colonial Development Fund has made important contributions both here and in Britain. It is perhaps early yet to arrive at conclusions, but before long it is hoped that important results will be achieved especially at the Sisal Research Station, Mlingano, in charge of Mr G. W. Lock, Agricultural Officer.

The industrial research work initiated at Lambeg, Northern Ireland, on behalf of the industry in East Africa promises results. The work is primarily concerned with methods of adapting sisal fibre to new uses; technical reports are also provided on the potentialities of the fibre obtained from the hybrids which are being evolved and species such as Blue Sisal. Arrangements were made for Mr W. H. Ewing, who is engaged on sisal research at Lambeg to visit the Territory early in the new year.

Towards the end of the year initial steps were taken within the industry to reorganize conditions especially in relation to better marketing. A new and strong organization, called the Sisal Growers' Association, has been formed in London of which all East African growers including London sisal companies are members and, in addition, important financial and selling houses in London. Already in co-operation with the Tanganyika and Kenya Sisal Growers' Associations new conditions concerning grading, contracts, claims and arbitration and so on, are being established as a necessary basis for firmer and more orderly marketing conditions. In this respect the industry is especially indebted both to the chairman of their association in this country, and to the chairman of the London organization. The new association is setting up a statistical and economic and trade research department for the industry, especially in relation to the commercial application of new uses for sisal. It is intended in due course to co-operate with other producing countries with a view to establishing better economic conditions generally for the world industry.

In order to assist the ameliorative efforts contemplated by the industry, the Sisal Industry Ordinance, 1938, was enacted at the request of the Planters' Association. Earlier legislation is consolidated into this ordinance which also provides for the registration of plantations and submission of periodical returns of the areas planted to sisal, the stocks of sisal on hand or in transit and particulars of labourers employed on plantations. It also provides for compulsory grading and the laying down of standards therefor.

That the task to which the industry is now addressing itself is not impossible is evidenced by the fact that in spite of a steadily increasing output, which during the last ten years has doubled, the annual production is still mainly consumed and rarely have there been any surplus stocks of any size and sisal is seldom shipped unsold. If the new proposals can only equate supply with demand at any given time, a better and more stable economic price for the product should be forthcoming. The department looks with sympathy on the efforts which are being made and, having regard to the scale of production already reached and especially to the uncertainty regarding consumption in the future, it is evident that at any rate until the statistical position of sisal is determined, new areas should not be thrown open for further cultivation of sisal except where it may be necessary for the more economic management of existing sisal plantations.

The following are the figures showing production in the various areas for three years:—

	1936 tons		1937 tons		1938 tons
Northern and Tanga Provinces ...	49,092	...	58,109	...	63,395
Central Line	22,702	...	19,438	...	24,851
Southern Province	8,765	...	13,085	...	13,154
Total ...	80,559	...	90,632	...	101,400

Coffee.—The total production of coffee showed little change from the previous season, exports amounting to 13,730 tons as compared with 13,612 in 1937. A fall in the production of Bukoba coffee was offset by an increased crop in the Northern and Tanga Provinces. The carry-over of Bukoba and estate coffee into the 1939 season will be smaller than is usual.

In Bukoba, while the control maintained by the grading service on the quality of coffee exported and the annual campaign against the *Stephanoderes* coffee berry borer ensure that the overseas markets receive a product of uniform quality, it is obvious from the proportion of defective beans that there is still room for improvement in the quantity and quality of production which is attainable by such cultural methods as maintaining and improving soil fertility, regenerating the older trees and replanting derelict plots. There was a distinct deterioration in the quality of the Arabica coffee presented for inspection; the wider margin resulting from the relatively heavy fall in the prices of Robusta encouraged petty traders and growers especially to treat Robusta beans for admixture in the Arabica offerings.

Although there was a contraction in the Bugufi coffee crop, the high standard of cultivation and increased plantings promise a bright future for this small but progressive native industry. A slight recession in native production in the Rungwe area was attributed to a bad attack of *Hemileia* leaf disease. The native coffee crop on Kilimanjaro established a record, and the coffee trees have remained in excellent condition, giving promise of another good season in the coming year. The marketing arrangements have proceeded smoothly, while greater attention has been paid by growers to pruning methods and time of pruning. The improvement in price has stimulated growers to greater efforts.

Non-native coffee planters have been taking active steps to further the organization of the coffee industry with wholehearted support for the

Territorial Coffee Association. Particular attention is being given to co-operative marketing. Although the Brazilian crisis affected the prices of hard coffees more severely than mild, the maintenance of reduced rail and shipping rates and a slight improvement in the prices of Arabica coffees have given a small but welcome relief to coffee planters. Greater security will accrue from the cultivation of a diversity of crops and the greater use of manuring and mulching in conjunction with the development of the most productive areas of estates with high-yielding coffee trees. A long harvesting period tended to offset the improved yields on Kilimanjaro. In the Southern Highlands the production of estate coffee fell slightly as a result of the dry season and the elimination of unproductive areas.

Licences for coffee curing works were issued as follows: Three at Bukoba, one at Moshi and one for the Southern Highlands. Amalgamation of such public utility establishments is to be desired rather than their multiplication.

The export figures of the main coffee areas during the past three years are as follows:—

Area	1936 tons	1937 tons	1938 tons
Bukoba	6,504	9,540	8,295
Northern and Tanga Provinces	5,174	3,717	4,963
Southern Highlands and other areas	458	355	472
Total	12,136	13,612	13,730

Of the 1938 export 10,920 tons were exported as clean coffee and the remainder in parchment.

The approximate export figures of native and non-native (estate) grown coffee are as follows:—

	1936 tons	1937 tons	1938 tons
Native	8,704	10,815	10,850
Non-native	3,432	2,797	2,880
Total	12,136	13,612	13,730

The following are the particulars of coffee inspected and graded at Bukoba during the year:—

Number of bags of 200 pounds

	GRADED			Rejected	Total Exported
	G.A.Q.	F.A.Q.	Triage		
Arabica	1,122	28,017	43	9,266	29,182
Robusta	300	63,942	71	4,773	64,313
					93,495

Cotton.—The cotton problem of the world is one of the most complex and it affects the prosperity of this Territory. In addition to the uncertainty caused by the stupendous amount of eleven million and a quarter bales held in Loan stocks in America and increased apprehensions over the European political situation and exchange restrictions, war in the East and a prohibitive tax on

raw cotton imported into India have virtually cut off markets previously of great importance to East Africa. As a result the price for cotton has reached the lowest level for very many years. At the same time cotton is still one of the most profitable crops to the African peasant. Even at last season's low prices the produce of an acre of cotton realized Shs 40/- over a great part of the Eastern Province (at Kingolwira receipts averaged about Shs 60/- per acre) and Shs 20/- to Shs 25/- in the Lake Province. This is net profit to the native grower who has no rent to pay, no especial equipment or anti-pest and disease materials to provide, and no agricultural indebtedness. This is fortunate as the cotton crop is vital to the development of the Territory. At the same time it is abundantly clear that the industry can no longer bear unnecessary and inordinate charges which may be levied to-day through inefficiency or by individual interests.

Cotton has very important agronomic qualities and when included in a crop rotation results in a saving and better distribution of labour throughout the year. It is one of the most drought resistant crops; in fact this quality sometimes brings the crop into disrepute as being the cause of famine. Possibly this is concluded because in a drought year cotton is often the only crop to survive, but the cultivation of grain crops has not been neglected; they have merely dried up and withered away, for example, in the year under review, in the Lake Province where the groundnut and grain crops largely failed in several areas through drought, cotton accounted for two-thirds of the total income of the Sukuma peasants and provided the means to purchase food from outside sources.

Nevertheless, while cotton is the most important cash crop in the rural economy of a large part of the purely native areas of the Territory, it would be most undesirable for the African to become a planter of cotton only. The objective of encouraging mixed cropping by the peasant producer was early supported by the Empire Cotton Growing corporation and, in addition to experimental work, the Corporation grants were extended to the trial and demonstration of mixed farming and the establishment of peasant settlements which were realized to be of great importance to the future of cotton production. The extent of the Corporation's grants has been £4,740 per annum in addition to a total of £6,850 for capital expenditure. A further capital grant of £3,050 has been approved and the recurrent grants have been renewed for a period of one year. A visit to the Territory to be made by Mr Parnell, of the Barberton Cotton Research Station, is properly awaited before consideration is given by the Corporation to proposals for a five-year programme of work. The visit has been arranged at the request of Government and the itinerary will include the several cotton areas and experimental stations. Mr Parnell's advice on several outstanding problems should be of great assistance and I am grateful to the Corporation for their consent to the visit as well as to the continuance of their generous financial aid.

The British Cotton Growing Association has continued to maintain the services of two ginneries inspectors seconded to the department from their staff. All ginneries are inspected regularly, and appreciable improvements have been achieved by the inspectors, not only in increased efficiency and savings in costs but also in better working conditions. The dust problem of the Lake Province ginneries was solved in collaboration with a well-known firm of cotton machinery makers who designed a dust-extractor hood which is now fitted to most ginneries in the Lake Province.

The territorial cotton export was 49,675 bales valued at £380,304. The potential output in a year of normal rainfall, even with the present standards of quantity and quality of agricultural effort, cannot be lower than a hundred thousand bales which is capable of being doubled by the adoption of improved yet simple cultural methods. Cotton stood up to the drought better than any other crop and results exceeded expectations. In the Lake Province, for example, the planting rains were scanty and late in arriving; this had an adverse effect on production but conditions improved as the season advanced. Cotton was better served by the weather in all areas of the Eastern Province except the Rufiji where the conditions for flood-land cotton were poor. Excellent yields were obtained by all those who had planted sufficiently early. In the Rufiji district the river floods were restricted and quickly receded with the early cessation of the rains inland. In the Northern and Tanga Provinces conditions varied from district to district and a reduction in total yield occurred except in Handeni where a record crop was harvested. The quality of the cotton harvested was well above the average as a result of the very favourable conditions for ripening the bolls and the small amount of insect damage, except in the Moshi area where there was a great deal of stained cotton.

Non-native production amounted to 4,255 bales or 17,020 cents. The crop is mainly grown on plantations as a catch crop in young sisal.

There are 418 registered cotton buyers, including two Arabs, 22 Africans, 22 Europeans and 372 Indians. A list of ginneries licensed in 1938 is given in Appendix III; these include thirty-two public ginneries, and one planters and four private ginneries which deal only with cotton produced by the ginnery owners. In addition there are two redundant ginneries in the Lake Province and two in the Eastern Province.

The figures of cotton production are analysed as follows:—

PROVINCE	SEASON'S PRODUCTION OF LINT IN CENTS				Seed-cotton in Cents *1938
	1935	1936	1937	*1938	
Lake and Western ...	158,820.7	170,712.5	123,194.4	86,084.6	265,122.8
Eastern ...	59,221.9	60,737.5	83,725.0	67,314.0	214,187.1
Tanga and Northern ...	13,155.5	34,321.4	31,934.3	20,478.8	62,395.6
Southern ...	2,955.2	3,706.0	6,840.5	2,566.0	8,280.0
Central ...	—	—	1,438.0	556.7	1,795.9
Total ...	234,153.3	269,477.4	247,132.2	177,000.1	551,781.4

*Approximate only.

Groundnuts.—Severe drought and infection by Rosette disease caused serious failure of this crop in the main producing areas. In addition food was scarce in these areas and, with the very poor prices offered, growers consumed the greater portion of their crop. Seed supplies were short at the end of the year and it is expected that the export trade in this commodity will take a year or so to recover. The quick maturing drought-resistant "bunch" varieties which have been introduced or selected from native crops are rapidly displacing the "spreading" types. The export fell from 22,251 tons in 1937 to the meagre total of 3,579 tons.

Sesame.—Production of sesame for export is almost exclusively confined to the Southern Province; in other areas it is grown only on a small scale and

then primarily for local consumption. It is a valuable oil seed and peasants are encouraged to sow it in their sorghum fields. During the year the record total of 5,241 tons was exported compared with 4,605 tons in 1936.

Copra.—Increased quantities of copra were absorbed by local crushing mills and soap factories with the result that the export of this commodity declined to 4,004 tons. In addition the sharp fall in price discouraged growers from drying copra and larger quantities of fresh nuts were consumed or sold locally. It is not possible to record any improvement in quality or extension of kiln drying as the premium paid for good quality is not at present sufficient to induce small producers to change their methods. Two steam-heated drying plants recently erected in Tanga for the production of high-grade copra for the extraction of edible oil did not start operating because of low prices.

Grains.—Weather conditions were unfavourable for the production of grain crops for the second year in succession and in some areas the maize, millet and sorghum crops were an almost complete failure. The expanding mining and plantation industries require increasing quantities of such foods for their labour so that even in favourable years there is no great surplus available for export. The volume and value of the rice exported, produced largely in the Lake Province, was maintained; the bulk of the export goes to Uganda and Kenya. The tariff which is levied on imported rice gives locally produced rice an internal value appreciably higher than the price ruling on world's markets and even precludes any possibility of this country competing in the nearby markets of Zanzibar and Mauritius.

Wheat growing is rapidly expanding in the Southern Highlands and in the Mbulu and Arusha districts. There is a tendency for natives living at the higher altitudes in these areas to replace tropical grain crops with wheat. During the year 248 tons of wheat were exported to Kenya.

The following are the export figures for the three main grain crops for the past four years:—

	1935	1936	1937	1938
Rice	4,922	6,513	8,857	8,196
Sorghums and millets	3,597	3,358	4,187	1,817
Maize	1,434	1,368	1,441	279
Total	9,953	11,239	14,485	10,292

Tea.—The allocation of 2,900 acres made to the Territory for the five-year period, ending 31st March 1938, under the International Tea Restriction Scheme, has been fully planted and a further allocation of 2,050 acres from the allotment made to East Africa has been given and will assist towards giving growers an area nearer the minimum economic unit of acreage. No new entrants are permitted and the conditions imposed by the International Committee have been strictly honoured. Abnormally dry weather was experienced in the tea growing areas of the Southern Highlands but, despite this, there was an increase in production although the yield per acre was lower than it has been in previous years; the increased production is accounted for by the recently planted areas which are now coming into pluck for the first time.

The total production of made tea amounted to 521,987 pounds of which 315,392 pounds were exported, the respective figures for 1937 are 381,848 pounds and 237,932 pounds. The price of Tanganyika tea on the London

it has been definitely established that it was not found in wax shipped from market was maintained until the last month of the year when it fell slightly in common with other growths.

The Tea Industry Ordinance was enacted during the year and *inter alia* provides for the establishment of a Tea Board to advise Government regarding measures to be adopted for the improvement of the industry and for the imposition of a cess on manufactured tea.

The export permitted to the Territory for the quota year ending 31st March 1939 was fixed at ninety-two and a half per centum of the standard export of 669,655 pounds for the year.

There are three factories manufacturing tea in the Southern Highlands and a fourth is being erected. There is one factory in the Usambaras.

Sugar.—The sub-quota of 5,100 tons made to this Territory for the export quota year ending the 31st August was fully exported. During the calendar year under review 4,955 tons were produced of which 4,032 tons were exported compared with 3,742 tons and 3,099 tons respectively in 1937. There is only one plantation company operating in the Territory.

Tobacco.—During the year the production of fire-cured native grown tobacco in Songea increased to 385 tons compared with 179 tons in 1937. In Biharamulo 32 tons of the same type of tobacco were cured and all of it was sold in East Africa. The quantity of this type of tobacco which can be absorbed by the local market is limited and enquiries are being made in regard to possible markets overseas.

Turkish tobacco is not a popular crop in Iringa and less than a ton of it was produced during the year. On the other hand, both fire-cured and flue-cured virginian tobacco are being produced in larger quantities.

Pyrethrum.—Twenty-five tons of dried flowers valued at £2,097 f.o.b. were exported during the year. The growers in the Southern Highlands formed an association and, in order to maintain the premium obtained by East African pyrethrum and to avoid inter-territorial competition on the pyrethrum market, following a suggestion of the Kenya Pyrethrum Board, negotiations took place which resulted in the Tanganyika Pyrethrum Growers' Association appointing the Kenya Farmers' Co-operative Association as the sole selling agency. This agency immediately appointed a manager at Iringa, despatched a press from Kenya and gave satisfaction in every way.

The potential production of the Southern Highlands and Northern Provinces is estimated to be at least 2,000 tons; the area also offers excellent prospects for dairy produce and fruit as well as tea. The rate of progress with pyrethrum will depend on economic and political factors. Labour supplies should present no difficulty. Despite the fact that with present prices there must be an appreciable increase in world plantings of pyrethrum, there seems little doubt that demand and new uses for the product will increase, especially as the consumption of vegetables and fruit is greatly increasing throughout the world and the use of mineral poisons is being deprecated.

OTHER CROPS AND PRODUCTS

Beeswax.—Climatic conditions were again favourable for bee colonies but, with a drop in price, production fell slightly to 686 tons, valued at £55,153, from the record of 738 tons achieved in 1937. Complaints received from the trade of the adulteration of beeswax were investigated by the Entomologist

in England whilst on leave. Two distinct adulterants were implicated, one an unknown fatty substance, the other paraffin wax. With regard to the latter it has been definitely established that it was not found in wax shipped from this Territory. For a time exports of wax were found to contain an unknown fatty substance, about one per cent of the wax being affected. This was but a passing phase. It has been suggested that this substance is the wax of a stingless bee of the genus *Trigona*, but the significance of the presence of "fatty wax" was to some extent exaggerated by the occurrence of adulterated wax not of Tanganyika origin. The tendency for shippers to cut up wax into pieces well below the maximum of eight ounces has also aroused comment, but the principal brokers are satisfied with the present method of shipping wax. Among the virtues of Dar es Salaam wax are its high melting point and the ease with which it bleaches, both of which properties are lost if the wax is remelted during preparation. Light coloured beeswax is preferred by the market but deeper colours depend to a great extent on the locality in which the wax is collected and are not the result of over-boiling. There is an all round demand for Tanganyika beeswax, and the market would appear to be far from saturation point in spite of increased production and improvement in quality in other producing countries.

Cocoa.—Eight tons of cocoa were produced at Sigi Segoma in the Tanga district and small new plantings have been made in this area.

Cinchona.—No quinine bark was exported during the year. Fresh plantings have been continued in the Eastern and Western Usambaras, where the area under cinchona now amounts to about 350 acres and is expected to reach over 1,000 acres within the next year or two.

Kapok.—An increased yield and the arrival at bearing age of some plantations in the Tanga Province led to an increase in the export of kapok to 110 tons from 78 tons in 1937.

Oil Palm.—The planting of oil palm in the Kigoma district has been continued; earlier plantings have not yet reached the bearing age. The plantation in the Usambaras increased the production of palm oil. In all seventeen tons of palm kernels and twenty-four tons of palm oil were produced mainly for local consumption.

Papain.—Exports of crude papain amounted to seven tons, valued at £3,505. Plantings and production have increased in the Arusha district, where an association of growers has been formed.

Essential Oils.—The export of ecuelled oil, obtained from the bitter orange, was 4,189 pounds, valued at £1,053 as compared with 4,704 pounds in 1937. A small quantity of petit-grain oil was distilled at Sigi Segoma and exported. Several distillations at Iringa of *Pelargonium radula* for geranium oil indicated that the variety under cultivation was useless for this purpose and planting material of the variety used in Kenya has now been established for further trial. Six and a half tons of lemon grass oil valued at £1,002 were produced in the Morogoro district.

Fruits.—The Muheza citrus crop, which supplies the Mombasa and Nairobi markets with good quality oranges, for the second year in succession was small, railings amounting to approximately 350 tons. Large quantities were taken by road for disposal in Mombasa. As a result of the bad season, the soft fruit crop in Iringa only amounted to two and a half tons as against eight tons in 1937, but the department obtained proper materials from Europe and demonstrated improved packing methods to eliminate wastage.

Kweme Nut (Telfairea pedata).—Interest in the cultivation of this nut has been maintained and earlier plantations in the Usambaras are now producing small quantities of nuts for export.

Gum (Copal and Arabica).—Greater interest has been taken in the collection of this wild forest product to supplement cash reserves following the fall in price and poor crops of cotton and groundnuts, especially in Shinyanga and the Central Province. Exports amounted to 1,274 tons, valued at £29,392, thus exceeding the record figure of 1,124 tons for the year 1934. While supervision and instruction in the grading of gum by natives have been maintained, all too often the petty traders spoil the better grades of gum by intermixing the poorer grades and so nullifying the departmental and producers' efforts to improve quality.

Onions.—The production of onions in the Kilimanjaro area continues to increase, though there is a danger that production of this perishable crop will exceed the local demand as was indicated by a heavy fall in price towards the end of the season. Exports amounted to 844 tons, valued at £6,687.

Cashew nuts.—Exports of cashew nuts amounted to 1,094 tons, valued at £6,060. These are grown in the coastal areas and an increase has been recorded in Mafia and the Temeke district as recently planted trees are now coming into bearing. The nuts are purchased on an exclusive licence in the Eastern Province; the market is open in the Southern Province.

Charcoal.—A very great waste occurs in the cutting of woodfuel and in the local methods of charcoal manufacturing, and a retort-kiln for the manufacture of charcoal was obtained from England for trial. The kiln proved a complete success under African conditions. Small branches, tree loppings and even maize cobs were all turned into charcoal without any waste. The output of the kiln, worked by two boys is five hundred pounds of good quality charcoal a day. The kiln is indispensable to the production of coconut shell charcoal on a large scale and this type of charcoal is readily saleable in large quantities in Europe to-day.

SECTION II.—DETAILS OF ASSISTANCE AND PROGRESS

The administration of the department is decentralized in the form of Circles under senior agricultural officers as follows:—

Circle	Provinces	Senior Agricultural Officer
North-Eastern ...	Northern and Tanga ...	... R. M. Davies.
North-Western ...	Lake and Western ...	... D. Sturdy.
South-Eastern ...	Southern and Eastern ...	... H. P. Smart.
South-Western ...	Central and Southern Highlands ...	(Vacant).

It has been decided not to publish the reports of the senior agricultural officers, hence the following reviews of the circles are given in more detail than heretofore:—

NORTH-WESTERN CIRCLE

Lake and Western Provinces

The agricultural staff consists of a senior agricultural officer stationed at Mwanza, and an agricultural officer for each of the following areas: (i) Mwanza district, including Ukiriguru Experiment Station, and North Kwimba;

(ii) Maswa district and South Kwimba; (iii) Shinyanga district and Lubaga Experiment Station; (iv) Musoma district together with Ukerewe Island; (v) Bukoba district and part of Biharamulo; (vi) Tabora and Nzege districts and (vii) Kigoma district. Agricultural assistants were posted to (a) Ukiriguru Experiment Station; (b) Lubaga Experiment Station; (c) Nyamahona farm and peasant settlement centre; (d) Tumbi peasant settlement centre; (e) Mwanhala peasant settlement centre; (f) Nyakato agricultural training centre; (g) Bukoba district and (h) Bugufi. A ginner inspector for the Circle was stationed at Mwanza and a senior agricultural assistant was responsible for the coffee grading service at Bukoba. A number of temporary district foremen were employed by the provincial administration in the latter months of the year to encourage increased agricultural production.

There was a complete failure of the normal planting rains in the cultivation steppe of the Lake and Western Provinces which entailed a determined effort to plant up drought-resistant and quick-maturing crops in the early months of the year. With a distribution of 5,145 tons of seed as compared with 4,389 tons in the previous year a further expansion in cotton production had been looked for. Inability to plant in time and an almost complete failure of the rains in December to January and again in April and May, however, led to a big drop in the production of cotton, and the drought caused a disastrous failure of the groundnut crop, exports of which were further reduced by the necessity to supplement the shortage of food. Among food crops eleusine, normally grown in the areas of higher rainfall, was little affected by the adverse weather and, unexpectedly, a good crop of rice was harvested. Pennisetum, grown mainly on the lighter lands of the cultivation steppe and being tolerably drought resistant, gave fair yields. Sorghums, the principal grains of the heavy lands, failed to a very great extent as did the maize and beans in the *miombo* bush country and Tabora. Even cassava, which is generally planted in March, in many instances failed to strike, except in Uzinza where good rains and a good crop enabled the natives to dispose of their surplus in Mwanza. In much of the central portion of the circle famine conditions prevailed towards the end of the year, though in a number of districts early precautionary measures, in the form of partial or complete prohibition of the export of food-stuffs, had been taken. At the end of the year there were shortages of seed for planting in many areas. Continuous propaganda had been carried out to prevent the sale of seed reserves of groundnuts but, even so, at the commencement of the 1938-39 planting season an acute shortage was observed and it is feared that groundnut production will have received a setback from which it may take a year or two to recover.

A year ago it was claimed that a loss of fertility in the "old lands" under continuous cultivation would in time be remedied by the adoption of the mixed farming methods which are demonstrated at the several centres in the drought-stricken areas. The benefits of early planting and manuring were well illustrated this year by a comparison of the crops raised at these centres, and on the plots of those enlightened individuals scattered round the districts who had imbibed the advice disseminated during past years, with the native crops planted in their vicinity which had failed. As concrete evidence that good farming, by manuring and by choosing the best time for planting, will increase productiveness, especially in a bad year, may be taken the yield from nineteen acres of "998" cotton grown at Lubaga which averaged 814 pounds of seed cotton per acre as compared with the estimated average for the district

of 250 pounds per acre, or the plot at Ukiriguru which yielded over 1,000 pounds of seed cotton per acre in this year of poor crops.

Remarkable results have been achieved in the manuring of food crops at the demonstration farms. In a controlled experiment at Tumbi (Tabora) applications of three and six tons of manure per acre increased yields of maize by 74 and 169 per cent respectively over untreated plots while from a manurial experiment at Mwanhala (Nzega) increases of 148 and 239 per cent respectively were obtained with similar applications of manure. With bulrush millet an application of nine tons of manure increased the yield by 31.5 per cent at Ibadakuli (Shinyanga).

Owing to the drought the Sukumaland produce and cotton markets experienced a bad year, especially in the groundnut areas where booth rents were reduced, so that the native treasuries have suffered a loss in the working of these markets. During the cotton season the competition which middlemen are expected to supply was virtually eliminated by agreement with the ginners who were able to obtain full control at all buying stores. The produce which passed through the markets amounted to 12,500 tons as compared with over 22,000 tons in 1937; the respective values were £75,000 and £180,000. Large quantities of gum were sold off the markets.

Despite increased consumption locally, the quantity of rice sold in the Mwanza district was 3,755 tons which is equal to the crop of the previous year. Increased plantings in Ukerewe and the northern part of the Nyanza Federation balanced reductions elsewhere, while the gradual adoption of improved methods of cultivation has helped. As a result of work at the Mwabagole Rice Station increased yields are being obtained from (i) closer planting, (ii) the levelling of dams to maintain an even depth of water and (iii) the planting of pure seed obtained from Mwabagole or by the greater care taken by cultivators in selecting their own seed.

The Western Province was very seriously affected by the failures of the groundnut and grain crops, the exports of the former dropping to 1,000 tons compared to the 7,000 tons average of the previous two seasons. The maintenance of adequate areas of cassava is not popular with natives partly on account of the depredations of vermin. The extension of rice cultivation was continued with further distributions of seed but, with the bad season, no great progress was made.

Because of the increasing use of manure, attention is being given at Tumbi and Mwanhala to fallows, types of manure, rates of dressing and the reactions of the crops of the district to manuring.

In Kigoma, where moderate crop yields were recorded, the sesame crop is once more becoming established. The growing of oil palms continues to receive encouragement and production from the earlier plantings is looked for shortly.

The purchase of ploughs by natives is proceeding rapidly in Musoma, particularly in North Mara, where some four hundred ploughs were sold. An outbreak of bovine pleuro-pneumonia entailing quarantine curtailed the training of oxen at Tarime, but special instructors were employed in the ploughing areas where a fair response has been made with strip ploughing on the contour to avoid the evils of soil-erosion.

In the Bukoba district the sanitation of the coffee plots remains a serious problem, though greater responsibility is being shouldered by the native authorities. Some of the chiefs are taking a greater interest in improved cultural methods and in the Nyakato agricultural training centre. Work in

the district is mainly centred on extending to coffee the practices of manuring and mulching customarily given to bananas and on the regeneration of the older plantations while demonstrating improved cultivation on established plots. As had been anticipated, there was a fall in the coffee crop, exports being swollen by a heavy carry-over from the previous season when stocks were held up because of the fall in prices. While the quality of the Robusta coffee was well maintained, much improvement having been effected in recent years as a result of steps taken to reduce the incidence of the coffee berry borer beetle (*Stephanoderes hampei*), there was a distinct deterioration in the quality of the Arabica coffee presented for inspection by the grader. This was largely the result of admixture of robusta coffee in an attempt to take advantage of the widening margin between the prices of these two descriptions. Although a new curing works was opened during the year, the bulk of the coffee continued to be cleaned by hand methods. By the licensing of coffee dealers a check is given to unremunerative competition. Out of 1,500 applicants, 836 licences, as against 855 in 1937, were issued and these were more than sufficient to handle the crop. Constant inspections of the stocks and storage accommodation of dealers check harmful methods of storage.

Steps were taken to control an increase in the coffee stem borer (*Anthonus leuconotus*) in the drier arabica areas as also in Bugufi, where this pest has been recorded for the first time. In Bugufi the coffee crop was a poor one following a dry year and thrips attack. The crop was sold by tender by the Bugufi Coffee Co-operative Society through the Provincial Marketing Board.

The Biharamulo tobacco crop exceeded expectations and amounted to 86 tons, of which 26 tons were first quality and 48 tons coil tobacco. This crop, too, was sold by tender through the Provincial Marketing Board at a price slightly above that of the previous year so that, with an increased crop, growers received £1,825 or nearly three times the amount paid out in 1937.

Erosion and some loss of soil fertility, it is reported by the Senior Agricultural Officer, have forced the natives in many parts of the Circle to seek and apply ameliorative measures, though we are still in the position of having to educate them to the need for soil conservation. Excluding the high rainfall areas, the main needs are water supplies to spread human and cattle populations, the use of manure, protection of hilltops and contour ridging, and all these are making progress. In the higher rainfall areas the planting of trees and contour hedges will do much to relieve the present position. Thus, in Bukoba the mulching of banana plantations is a universal practice, but the application of the same principle to coffee is not yet universally accepted, while future work envisages the permanent demarcation of contour grass strips in the communal cultivations. In Musoma hedging, started as a means of preventing damage to crops by grazing cattle, is now recognized as a valuable aid to maintaining soil fertility and the extension of contour strip ploughing and hedging of all cultivated fields is contemplated. Nine hundred hills have been closed to grazing, cutting and burning in the Nyanza Federation and a further three hundred and thirty in North Kwimba. In much of Sukumaland forms of grazing reserves have been instituted and the ridge cultivation of crops has been firmly established on the lighter granite soils. One new dam was built in South Kwimba and water supplies have been improved in Maswa, while six large tank dams were dug in Shinyanga. A survey of villages without access to fuel supplies was made in Maswa and a one-acre fuel plantation sown in each such village, while forty acres of plantations were sown in Shinyanga ;

sisal suckers were planted as contour hedges. Extension of this work in these areas and also to Tabora and Nzega districts provides a full programme for the future. The planting of windbreaks and of contour hedges in field crops is being extended in Biharamulo and in Bugufi, where six miles of contour hedging were planted. The windbreaks planted both here and in Kwimba are now yielding poles from thinnings, making some return for the labour spent on them. In Uha manuring of cultivated lands near the homestead is an accepted principle. Over three miles of broad based contour banks were constructed in Kasulu and thirty-six check dams across sloods were made, while ten miles of windbreaks were planted by the Forestry Department.

The damage done annually by porcupine, baboon and pig is very considerable and protection for the peasant cultivator is essential if his support is to be obtained in the protection of hilltops; regeneration of the bush providing a safe refuge for vermin. With the appointment of district foremen to assist with the extension of production, it was possible to restart poisoning by native vermin destroyers who had been retrenched while no adequate supervision was available.

A detailed survey and report has been made by Mr D. Malcolm, Administrative Officer, with assistance from Mr J. G. M. King, Agricultural Officer, Shinyanga, covering all the various aspects of land utilization and erosion in Sukumaland together with recommendations for their control. Orders for the prevention of soil erosion have been made in the Mwanza, Kwimba, Maswa, Shinyanga, Bugufi and Kigoma districts.

A small competitive agricultural show was staged by former pupils of the Nyakato agricultural training centre to which, as an attraction to visitors, non-competitive exhibits were contributed by other districts of the Circle. The show was well attended by two thousand local natives and their chiefs. The exhibits were used later for instructional purposes for local and visiting African instructors and past and present pupils.

The native authorities of the Lake Province appreciate that a well educated subordinate African staff is essential to disseminate the results of experimental work to field practice and to carry out the more detailed work of supervising the progress and directing the efforts of the cultivator. Thus, with the assistance of the native treasuries of Mwanza, Kwimba and Maswa, a school for the training of African instructors, to be drawn from schools at which they have reached at least Standard VI, has been erected at Ukiriguru to provide a course of eighteen months' duration; a preliminary course lasting two months was held for serving instructors after its completion. Instructors from Bukoba, Tabora, Kwimba and Maswa also attended at Ukiriguru for special courses. Short refresher courses for district instructors or market supervisors were held in Bukoba, Shinyanga and Tabora.

The incidence of pink bollworm was severe in the cotton of Musoma, Ukerewe and Nassa, but only occasional specimens were found in the main Sukuma areas and Uzinza and in May none were found more than twenty miles inland from the lake shore. Special measures were taken to ensure early and thorough uprooting and burning of cotton residues.

An invasion of migratory locusts from Kenya in October passed through the Musoma district, Ukerewe, and southward as far as Shinyanga whence they moved westward via the Kahama-Mwanza boundary to the Emin Pasha Gulf where they were lost. Egg-laying occurred but the young hoppers were easily dealt with by beating in early December. A large swarm passed through

the Kasulu highlands in December. No damage to crops by flying locusts or hoppers took place.

Regular inspections have been made of the ten licensed ginneries in the Lake Province by the ginnery inspector and much has been done to ameliorate the working conditions of the labour by the provision of dust-extractor hoods at eight ginneries which operated open-lattice seed cotton openers and by improvements in the ventilation of several of these ginneries. He also made recommendations regarding the provision of safety devices in the three coffee curing works in Bukoba and these were carried out by the owners.

NORTH-EASTERN CIRCLE

Northern and Tanga Provinces

The senior agricultural officer in charge of this circle is stationed at Moshi with agricultural officers at (i) Arusha including the Mbulu district and the Sonjo area of Masailand, (ii) Moshi, (iii) Lushoto and (iv) Tanga. Agricultural assistants were stationed at (i) Moshi and (ii) Handeni.

The long rains set in seasonably at the end of March but finished too abruptly at the end of May. In coastal districts the long rains were exceptionally heavy. Excellent harvests of food crops were obtained in all areas, except Mbulu, both from the long rains plantings, and, with the exception of the Western Usambaras, from the short rains plantings of 1937 as well. There was a decrease in sisal production in the Northern Province but the output of the Tanga Province amounted to 58,485 tons, representing an increase of over six thousand tons on the previous year's total. The export is a record in volume but not in value. Regeneration and fresh planting have more than kept pace with the abandonment of worked-out areas. Several new blocks were planted up in the Tanga Province where there was a noticeable improvement in the standard of cultivation on many estates.

The season was favourable for coffee. A most satisfactory feature was the excellent condition of the trees at the end of the season and the promise they give of good yields for the year 1939. The native coffee crop on Kilimanjaro was exceptionally large. The Kilimanjaro Native Co-operative Union sold the native coffee crop in the Mombasa and Nairobi coffee exchanges. The average price realized was the highest since 1933-34. Culturally, there was a better response from the native growers to advice on pruning methods. Mulching with banana trash is becoming more a common practice. New plantings have been fewer; this is inevitable as suitable coffee areas are becoming scarce on Kilimanjaro, also the provision of land for food crops is an urgent consideration.

European estates are in good upkeep in the Northern Province. There was an appreciable decline in coffee production on European estates in the Usambaras and planters are now giving more attention to alternative crops such as oyster nuts, cinchona, tung and derris. There was a small increase in the number of native growers in this area.

The plantation maize industry in the Moshi district together with the native producers in that area experienced another poor season. Climatic conditions were good in the maize belt but a plague of leaf folding caterpillars did considerable damage to the young plants just at the time when they were most vulnerable to attack.

Wheat growing in parts of the Arusha and Mbulu districts is expanding rapidly in the extensive areas which are suitable for this crop. The season was very favourable and good yields were obtained, stem rust disease causing little damage. The average price for wheat in Arusha was eighteen shillings per bag, the bulk of which was exported to Kenya. A group of native growers in the Arusha district purchased a power thrasher and engine and quickly disposed of their crop.

The total quantity of purchases of native grown seed-cotton was 2,722 tons compared with 3,911 tons in the previous year. Except for Handeni district which secured an increase of thirty per cent with a record crop all the other areas produced much less than last year. Apart from Handeni the numbers of growers in all other areas has declined and the fall in price of cotton at the close of the previous season induced many growers to substitute maize for cotton; a further restricting factor was the early cessation of the rains. The beneficial effect of three big cotton crops on the economy of the Handeni district and the welfare of the inhabitants has been remarkable. The production of plantation cotton in the Mbugwe area has declined and there is some doubt as to whether the area near the Rift wall is really suitable for this crop.

The development of the sugar plantation near Moshi has to conform to the international restriction on exports; the sub-quota allocated for the last quota year was filled.

The orange crop in Muhesa was again small for the second season in succession; the local production of grapefruit for which conditions are admirable is being encouraged. Papain of excellent quality is produced in the Northern Province but care must be taken in extending plantings as the market for this very specialized commodity is limited. Growers have formed an association to facilitate marketing through one channel. Interest in derris cultivation continues and expansion is only limited by the supplies of planting material available. The export of bitter orange ecuelled oil from an estate in the Tanga district is being maintained and small quantities of petit-grain oil are now being distilled.

There is a steady expansion of onion growing on Kilimanjaro whence 850 tons were exported. The Arusha and Mbulu natives are also interested in this crop. The local market in the Tanga Province is liberally supplied with vegetables and potatoes from the Usambaras.

The rice crop in the Same district was up to average but in the Usambaras weather conditions were not as favourable and the output declined. The distribution of selected seed to growers in the latter area has now been completed.

The quantity of tea manufactured in the Western Usambaras again shows an increase on the previous year's production. Eight tons of cacao were exported from the Tanga district. There was a small increase in the export of kapok, of which large quantities are used locally. Increasing quantities of copra are being milled in Tanga with the result that the exports of copra have declined.

The intensive campaign for the provision of anti-soil erosion measures was continued in the Usambaras and good progress is recorded. The most important measures advocated are the placing of weeds and crop residues in contour lines during the cultivation of the food plots. In addition contour hedges of indigenous plants are planted. But a matter of urgent concern in this district is the serious erosion caused by cattle and the large and numerous

herds of goats which are a serious hindrance to regeneration of the vegetative cover. It is estimated that, in the Western Usambaras, the numbers of cattle have doubled within the last five years as a result of the elimination of east coast fever which has followed the disappearance of ticks from the eroding and denuded hillsides. On Kilimanjaro the practices which have been advocated over a number of years are becoming a matter of routine amongst large numbers of native cultivators. Particular attention was given to lands planted with eleusine. Small plots carrying annual crops are being effectively contoured with hedges, bunds and contour weed lines while the large blocks of continuous cultivation are treated *in toto*. The demarcation of all riversides has now been completed. Natives are encouraged to plant trees in riverine areas and several communal efforts were undertaken during the year. On Mount Meru all occupied lands are being enclosed by hedges and contour hedges of Napier grass are being planted on the hillsides. In Same district special attention is being given to the steadily increasing numbers of plots at the foot of the mountain slopes and considerable areas of these gentle mountain slopes are being dealt with in large blocks by throwing contour barriers across them at intervals. A comprehensive scheme has been planned to alleviate conditions in the Mbulu Highlands where soil erosion, especially in the western and central areas, is causing grave anxiety. It has not yet been possible to start this work. Many of the leading maize growers on the lower slopes of Kilimanjaro are adopting anti-erosion methods and Government purchased a mechanical terracer for use by them in the construction of broad-base terraces.

It is pleasing to record progress in the development of the dairy industry in the Ngare-Nairobi area where farmers have realized that the provision of fodder during the dry season is essential and there is now a tendency to change over from ranching to a more intensive system. A party of chiefs from Moshi district accompanied by the district officer and agricultural officer visited the Kenya Highlands where they were kindly given facilities for seeing improved methods of agriculture practised there. They afterwards visited Morogoro and the Kingolwira peasant settlement. The party was particularly interested in the cattle which they saw and their management; probably for the first time the chiefs realized that "the bull is half the herd." Some of the lessons learnt are already being followed.

Much is being done to make the Chagga on Mount Kilimanjaro realize that an improvement in the very poor quality of their cattle can be effected by such simple measures as the provision of better housing with adequate ventilation, by the prevention of in-breeding and by making an attempt at selective breeding. In addition cattle owners are encouraged to plant fodder crops and feed cotton seed. The native occupier of the demonstration holding near Moshi township has now become a specialized dairy farmer and during the year sold milk to the value of four hundred shillings. The fact that this man has maintained his cattle in good health and is able to grow bananas in the lower foot-hills has not escaped the notice of natives in the higher areas and some of them are now following his example.

It is gratifying to record that there is an increasing demand for cotton seed for feeding cattle. All locally produced supplies of cotton seed and coconut, sesame and groundnut cake from the oil mills could be utilized in this Territory which cannot afford to export valuable feeding stuffs.

SOUTH-EASTERN CIRCLE

Eastern and Southern Provinces

During the year the departmental circle organization was applied to the Southern and Eastern Provinces which were combined into the South-Eastern Circle. The senior agricultural officer in charge of the Circle is stationed at Dar es Salaam with agricultural officers at (i) Morogoro, (ii) Kilosa, (iii) Utete and (iv) Lindi. Agricultural assistants were posted to (i) two to Kingolwira settlement centre, (ii) Masasi (for part of the year), (iii) Songea and (iv) Mafia. A senior overseer worked in the Bagamoyo district.

Generally the short rains of 1937 were scanty in the Eastern Province and the long rains were late in arriving and were of comparatively short duration. The floods in the Rufiji district soon subsided. Weather conditions in the Southern Province were also unfavourable, particularly in the coastal districts and along the Rovuma valley. As a result the yields of grain crops were abnormally low but early planted cotton yielded excellently in quantity and quality. Sisal was unaffected.

Wherever a sufficiency of root crops had been planted and reserves maintained food supplies were adequate for local needs. Large quantities of maize were imported into the Morogoro district to feed sisal labour, which should not be necessary in a district of this size with such admirable and varied farming conditions. There are still areas, but they are small and localized, where natives will not plant enough root crops and maintain a reserve unless native authorities exercise their authority to enforce this.

A big increase in the cultivation of legumes resulted from advice given to cotton growers to plant catch crops of cowpeas in their cotton fields with the short rains.

Despite the poor price of sisal, production was increased both from estates on the Central Line and from the Southern Province. Planting programmes are being carried through and a further increase in output must be expected in the near future.

The fortunes of cotton growing varied very considerably from district to district in accordance with weather conditions and the degree of encouragement given to natives to maintain or increase their plantings. Late planting was again the cause of failure and waste of much work. A record crop was picked in Bagamoyo and in Morogoro the best crop since 1928 was harvested. Despite warning, the Rufiji tribesmen instead of planting both upland and flood-land cotton relied solely on flood-land plantings, but the floods were restricted and the output was less than 600 tons of seed cotton compared with 2,134 tons in the previous year. Cotton production in the Southern Province showed no improvement; weather conditions were not entirely satisfactory but late planting and lack of interest in the crop are the principal causes of failure.

The production of cotton by non-natives fell off considerably in the Morogoro district, but increased slightly in the Kilosa district. Until prices improve it is unlikely that there will be any appreciable increase and also much of the land on which cotton was planted is now carrying mature sisal. A good deal of alienated land in the Morogoro area is also rented for native use. The total production in the Eastern Province by non-natives amounted to 3,176 bales.

As a result of the dry conditions which prevailed in 1937 the coconut crop suffered and production declined, particularly in the Bagamoyo district; in Mafia island growers harvested comparatively good crops of nuts. Demon-

stration copra drying kilns of a type suitable for small holders was carried out in Mafia. The product was of superior quality and obtained a premium in price. The kilns have aroused interest but no native growers have thus far built their own. The quality of copra generally produced is poor and there is no prospect of improvement until growers are able to allow their nuts to ripen before picking, this however is impossible while extensive thieving continues. An appreciable proportion of copra exported from Bagamoyo is not strictly of native production and the general quality is raised by a leavening of kiln dried copra manufactured by non-natives.

The bulk of the sesame exported from the Territory is grown in the Southern Province in a simultaneous rotation with sorghums, the most important food crop, and a record crop of 5,228 tons, valued at £53,317 was shipped. The white seeded type is in greater demand but little progress can be recorded towards the elimination of mixed and brown types. A simple technique of selection in the field has been worked out but until the trader becomes more discriminating and pays a premium for white sesame there is little incentive for the growers to improve quality. Some growers whose earlier plantings failed were persuaded to replant, and at first sceptical, they later followed the advice given them and harvested good crops. Sesame is a popular crop with native cultivators and efforts are being made to introduce it into the Morogoro district where it could be grown with the sorghum crop.

The export of cashew nuts from the Eastern Province including Mafia Island was initiated. The nuts were purchased by a local firm operating under an exclusive buying licence. The prices paid were the ruling prices in operation on the open Lindi market. Shipments from Mafia Island amounted to 203 tons and from Temeke, seven tons. The majority of the trees in the Temeke district are still immature and are only just coming into bearing.

Very much larger crops of European potatoes could be grown in the Uluguru mountains but lack of organized marketing arrangements results in haphazard distribution. Seed for supplying local needs is grown on a native authority seed potato farm. Natives are now taking more interest in the production of onions which should find a ready market. Vegetable growing is a thriving industry in parts of the Uluguru mountains. Organized marketing and quick efficient transport arrangements are a first essential in handling perishable produce and are necessary if the vegetable industry is to progress.

Native cultivators are always anxious to grow tobacco and little encouragement is needed to effect large increases in production. The quality of tobacco produced, however, is all important when local markets have been supplied and the product must be sold on a very exacting overseas market. The whole crop of 385 tons grown in the Songea district was marketed by the Ngoni-Matengo Co-operative Marketing Union, Limited, a total of £6,915 being paid out to the growers. The amount of tobacco which the local markets can absorb is limited and if the industry is to expand an outlet for the produce must be found elsewhere. It is, therefore, essential that the standards of quality should conform to the requirements of the overseas market. The tobacco supplied is fire-cured and the provision of fuel for firing is a problem which needs consideration and in particular in relation to the general destruction of forests which might arise.

Accelerated soil erosion, destruction of natural vegetation and uncontrolled burning in the Uluguru mountains in Morogoro district and in the Usagara and Ukaguru mountains in Kilosa district are rapidly denuding these essential

watersheds of trees, vegetation and soil. The steepness of any slope is no deterrent to the native cultivator in spite of the fact that his returns from this land must be meagre in the extreme.

Some attempts are made to protect the soil cover but they are ineffectual on the steep slopes which should never have been cultivated at all. Increasing numbers of these people are forced to grow at least a part of their food crops on the plains and, as stated above, many of them are now paying appreciable sums of money in rent to owners of land which has been alienated. It is of the utmost urgency that these watersheds should be protected to the fullest extent and if this is to be done in time it will be essential to encourage some of these hill people not only to cultivate their crops in the plains but to transfer their homes there. Organized settlement will be essential. A lead has been given on the Kingolwira peasant settlement centre where the returns obtained by the demonstration block of peasant holders are much greater than the returns from crops planted on badly eroded hillsides. A start has been made in the Kilosa district at growing black wattle as windbreaks but in three areas the young seedlings were destroyed by fire.

Extensive damage to crops in Ulanga district is caused by marauding game, chiefly hippopotamus, eland and buffalo.

SOUTH-WESTERN CIRCLE

Central and Southern Highlands Provinces

It has not yet been possible to post a senior agricultural officer to establish this Circle, and the area has continued to be administered from agricultural headquarters. Agricultural officers have been stationed at (i) Dodoma, for the Central Province; (ii) Itheme for the experimental station and the Iringa, Dabaga, Njombe and Lupembe areas; and (iii) Mbeya for the Rungwe, Mbosi and Mufindi areas. A senior agricultural assistant is stationed at Tukuyu, mainly for native coffee and food crops and anti-erosion work, and an agricultural assistant is posted to the Itheme experimental station. For the first time since 1934 it has been possible to post agricultural staff to the Central Province, while the agricultural officer was transferred from Tukuyu to Mbeya (provincial headquarters) which is more central to the large area served by him.

In all areas except Mbosi the rainfall was generally insufficient and badly distributed, especially in the Dodoma district and at the lower altitudes in the Southern Highlands Province. January and February were dry months and drought conditions set in early.

Following the early drought it was necessary to replant the cereal crops in the Central Province on a large scale and the slow-maturing sorghums, millets and groundnuts grown in these areas received a further setback from the early cessation of the rains. In the Singida and Kondoa districts conditions were not so severe as in Dodoma and fair crops were harvested in most areas. The benefits accruing from sound farming practices were clearly demonstrated in this poor season and the good crops harvested by the few natives who had manured their fields have led greater numbers in the Dodoma district to extend the practice to their own fields preparatory to their 1939 plantings. Contour ridging has benefited crops: the acceleration of rate of growth was clearly demonstrated in the maize cultivations of the Kondoa district. The introduction and establishment of quick-maturing, drought-resistant varieties of millet, sorghum and maize is of the first importance to these dry areas where the desired increase in plantings of cassava and sweet

potatoes is restricted by damage from stock due to shortage of grazing. As a palliative to recurrent food shortages, administrative pressure and the distribution of planting material are extending the cultivation of these crops. Groundnuts were a failure: due, in addition to shortage of rain, to the cultivation of slow-maturing, spreading varieties and to insufficient tillage. In the campaign for increased production set in motion towards the close of the year, 180 tons of local groundnut seed were distributed in the Dodoma district on a refund basis, but the introduction of a quick-maturing "bunch" variety would materially assist in ensuring greater regularity in yields. A fall in the production of cotton in the Singida district was recorded following the drought, however the area is still considered to be suitable for future expansion. Gum exports from this district at 207 tons established a record for the area, while in Dodoma 49 tons were sold. Following instruction, the quality of the gum was improved but further advance has yet to be made in its preparation and handling after sale. Scope, too, exists for improving the cultivation of rice by adopting the better cultural methods now generally employed in the Lake Province and by the restriction of dealing to paddy so that the damage caused by hand cleaning may be reduced.

With the establishment of pyrethrum in the Iringa district and the production of about twenty tons in 1937, a Pyrethrum Growers' Association has been formed and the Kenya Farmers' Association was asked to handle the product. At the same time Government was requested to enact legislation to compel all pyrethrum growers to sell their crop through the authorized agents. Deliveries of flowers totalled 33,100 pounds by the end of the year and the first consignment shipped to America realized £115 per ton on the Kenya basis of 1.3 per cent pyrethrins. The Iringa and Njombe districts have always lacked facilities for marketing general farm produce and it is hoped, with the advent of the Kenya Farmers' Association, that the disposal of other crops, as their volume increases, will be put on an economic basis. Wheat, tobacco, pig and fruit organizations are following the lead given by the pyrethrum organization. In the drier areas expansion in the production of these products and other annual crops such as beans and potatoes is taking place. Dabaga and Mufindi must develop on pyrethrum and tea where suitable and where permissible for the latter crop.

The acreage under Virginia fire-cured tobacco was increased in the year under review but production at 66,000 pounds showed little change as appreciably reduced yields followed the bad season, thus convincing planters of the necessity for irrigation, as advised in past years. A scheme to cultivate flue-cured tobacco, the present production of which is negligible, is being launched by planters in the Nguruhe area. The cultivation of wheat suffered a severe setback both on account of the drought and because Yellow Rust (*Puccinia glumarum*) and Stem Rust (*Puccinia graminis*) made their first general appearance in the district, the K4 form of the latter being particularly severe. Thus sales of wheat fell from 455 tons in 1937 to 261 tons. The Plant Breeder of the Kenya Department of Agriculture visited the area and furnished valuable advice on varieties, yields, methods of cultivation and the blending of flour. Fruit production, too, fell to 2½ tons from 8 tons in 1937 but, with improved packing facilities, wastage has been eliminated. Although the bacon factory has made progress, there is an increasing scarcity of pigs.

The manufacture of tea in the Mufindi and Rungwe areas increased from 230,974 pounds in 1937 to 281,967 pounds, approximately half of which was

exported. Output was restricted by the dry conditions and it became necessary to pluck more coarsely in order to supply the expanding local market. The high standard of tea planting and cultivation has been maintained but in the old tea gardens at Mufindi manuring is now necessary. Three factories manufactured tea throughout the year and a fourth will commence shortly. A further consolidation of acreage took place at Rungwe and the new allocation made to the Territory by the International Tea Committee will enable uneconomic units to expand. Planting will commence in 1939. The Tea Planters' Associations have rendered valuable assistance in the application of the Tea Restriction Ordinance. There was a fall in the production of estate coffee in the Rungwe, Mbeya and Mbosi areas following the dry season, *Hemileia* attack and the elimination of poor coffee at Rungwe. The control of erosion, the use of manure and the planting of light shade are putting the industry in a healthy condition and many planters are now adopting the multiple stem system of pruning. A coffee curing works established at Mbeya should materially assist growers by reducing transport charges. Demonstration plots have been maintained and the uniformity trials were continued. A sub-station of the coffee research station at Mbosi was opened; nurseries were prepared and shade trees planted out preparatory to planting experiments in 1939.

While new plantings continue, the native coffee crop in Rungwe received a setback from the persistence of *Hemileia* leaf disease which spraying failed to check, so that there was a drop in production. As in past years, the coffee was marketed by groups of natives under the supervision of departmental staff. Some dissatisfaction was shown at the fall in prices. The crop was sold by tender. Twenty-four coffee pulpers were purchased by individuals or groups of growers and were set up under departmental supervision. Advances made from the native coffee funds to assist with their purchase mostly have been recovered and growers outside these combines pay a small fee for pulping.

There was a heavy decline in native annual crop production in the *Brachystegia* savanna areas. The average annual sales of maize in the Iringa and Njombe districts of around 1,700 tons, disposed of mostly to the Lupa mine-fields or on local forms for posho, fell to 320 tons, and export from the Iringa district was prohibited for most of the year as a precaution against food shortage. In the Mbeya district, on the other hand, there was a general abundance of food crops and maize production increased, supplies being sufficient to meet all demands. The cultivation of rice, being an irrigation crop, has shown progress and sales by natives in the Southern Highlands Province were estimated at 1,000 tons, and this should increase with the extension of furrows. Encouragement is being given to the cultivation of groundnuts, wheat, vegetables, beans, peas, buckwheat, a popular crop with natives in the Mufindi area, mangoes, peaches and citrus to improve the native diet; surplus production finds a ready and profitable sale to the goldfields.

In the Iringa district cultivation by natives on contour ridges, enforced by simple rules for several years, has been largely followed throughout, though no support for this has been forthcoming in the Njombe district. More serious is the wholesale destruction of forest on the Great Escarpment between Mufindi, Dabaga and Ukwama by a sparse population practising shifting cultivation with burning to ameliorate soil conditions, and this has seriously denuded the heads and banks of streams. The natives concerned are on a bare subsistence basis and cultivate no economic crop. Acid-tolerant crops, such

as buckwheat and peas, have been introduced to alleviate the necessity to shift cultivation. Proposals have been put forward for reafforestation and in the meantime forest and fruit trees have been issued in large numbers to natives to encourage planting around their homes. In the *Brachystegia* savanna of central Uhehe grass-burning, to provide early grazing, and the burning of trees for eleusine cultivation have produced serious sheet-erosion and rules have been introduced prohibiting tree cutting and burning for eleusine cultivation and limiting grass burning. On the dry Pagawa plains, concentration of cattle at the Ruaha river and its environs has caused serious destruction of soil cover and erosion approaching desert formation. The opening of a cattle market has had little effect in reducing numbers. A general survey is projected to find or provide water away from the river so that a system of rotational grazing may be introduced, but some control of cattle numbers is also required. Native coffee plots in the Mbeya district are well protected by terracing or contouring with banana trash. A large measure of control has been attained in the general cultivations by contour ridging and draining in the Rungwe area and this is now being extended to the Mbeya area.

Erosion on European plantations in the Southern Highlands Province through over-cultivation or wrong methods is well controlled. The pyrethrum planters in the forest areas, following the excellent example of the tea planters, are terracing all lands for planting and ninety-five per cent of pyrethrum in the Iringa district is planted on the contour or on terraces so that Dabaga, East Mufindi and West Mufindi, all tea and pyrethrum areas, are models of correct planting. In coffee the control is not so effective, but the majority of the planters have adopted some measure of control. The assistance of trained African instructors for the laying out of contour banks or irrigation channels is in great demand by planters in these areas and also in Nguruhe where contour ridging of wheat and tobacco fields has made great progress, Sao and Ifunda alone lag behind.

A general agricultural survey of the Central Province undertaken by the agricultural officer emphasized the urgent need for conservation measures to ameliorate the advanced degree of soil erosion which has resulted in the past decade from the needless destruction of thousands of acres of forest for cultivation with no attempt to protect the surface soil. Widespread sheet erosion and gulying have inhibited the regeneration of grasses and any but the poorest thorn-bush on the abandonment of cultivation and over-stocking has accelerated this deterioration to the extent of producing wind-blown sandy wastes in certain extreme cases. Two main causes for this are undoubtedly shortage of water and tsetse fly encroachment, so that over-grazing prevents the formation of pasture. The measures requisite to controlling erosion in the various areas include the application of rotational grazing to all eroded and erodable lands; the turning of old crop lands to ley pasture and its maintenance; the cultivation of crops on contour ridges; the preservation of the remaining forest and the reafforestation of denuded hilltops and catchment areas; the gradual transference of the population and stock to more fertile and less erodable lands with the provision of ample water supplies; and the regulation of settlement with the introduction of mixed-farming methods and dipping facilities. But a prerequisite is a plan to control any increase in the numbers of stock.

In the year under review a start has been made by laying down demonstrations of contour ridging on individual plots and at sub-chiefs' headquarters

in the Kondoa district. The cultivation of groundnuts on ridges was enforced in the Mpwapa division of the Dodoma district and in the Singida district two large-scale anti-erosion demonstrations were inaugurated with the construction of broad-based contour banks. By constructing four dams in the Bwaga plains a very successful rotational grazing scheme was inaugurated by the Veterinary Department which provided grazing for nearly ten thousand head of cattle, sheep and goats allowing a resting period of nearly six months for the normal grazing lands. Dams have been constructed in the Konga area for extending the scheme in 1939. Anti-soil erosion rules have been made in the Dodoma and Singida districts for the protection of cultivation lands and the control of wet-season grazing.

CROP EXPERIMENTATION AND RURAL DEVELOPMENT

The general agricultural stations situated at Ukiriguru, Lubaga, Morogoro, Kingolwira and Zombe are almost exclusively concerned with problems of native agriculture. Although experimental work to elucidate local problems receives special attention the functions of these stations are very diversified, as they necessarily must be if they are to take a full share in the agricultural development of the districts in which they have been placed. In the year under review cultivators of annual crops were hard hit by the unfavourable weather conditions but on the agricultural stations, although yields were reduced, they were superior to yields obtained by peasants in the surrounding districts. This has created a profound impression on the native cultivator and he has assimilated the value of many of the cultivation methods demonstrated by contrasting his own crops with those he has seen on the stations. The comparatively satisfactory returns have not been obtained through improved seed alone nor through the use of manure in any one year; they are the result of the good farming practices which have been evolved after trial and experiment and have as their ultimate objective the increase and maintenance of soil fertility so that the cultivator will reap bumper harvests in good years and even in years of poor rainfall will obtain fair crops.

In addition to experimental work on cultivation methods and the selection, testing and multiplication of seed of food and cash crops any work which will further the advance of native agriculture and the extension of improved methods into the field is undertaken on these stations. We thus have on some of the several stations, a training school for departmental and native authority African instructors; training courses for retired askaris; centres for training cattle for pack-work and ploughing; demonstration earth dams for water conservation; breeding pens of pure-bred poultry; demonstration of improved housing; and carpentry, brick-burning, building and such crafts and trades.

The sisal and coffee research stations confine their experimental work to these two crops although minor trials on other crops and related problems are given attention. The end of the first stage in the programme of work laid down for the Lyamungu Coffee Research Station has been reached and clonal material of selections made in the field is now available for planting up *ad hoc* experiments to investigate problems concerned with the environmental conditions of the coffee tree and its treatment. Experiments on the Sisal Research Station are now beginning to show the trend of different treatments. Close contact is maintained with the research workers at the Linen Research Institute, Lambeg, Northern Ireland, where research into the industrial utilization of sisal fibre is carried out.

In a territory with such diverse soil and climatic conditions and such a large number of crops under cultivation, there are so many problems requiring investigation that, so long as the cost of research is met from annual revenue, the greatest care must be exercised in order that expenditure on research does not restrict or cripple extension work and the practical application of results which have already been proved on experimental stations and farms. Very large increases in native crop production can, for example, be achieved by such simple means as more timely planting and better spacing, yet the lack of educated instructors and an illiterate population prevents the Territory reaping the full benefit of experimental and research work. This can only be remedied by increased expenditure on education.

The reports for the year under review of the Morogoro, Kingolwira, Zombe, Ukiriguru, Lubaga and Theme Stations are given in Pamphlet No. 24, and that of the Mlingano Sisal Research Station in Pamphlet No. 25. The Coffee Research Station report deals with the twelve-month period ending the 31st March and is published separately.

TANGA PROVINCE

The Sisal Experiment Station, Mlingano

Some of the sisal experiments have now reached the cutting stage. Leaf yields were recorded for individual plants and yields of fibre were satisfactory. The results do not permit of any definite conclusions being reached at this stage since it is necessary to ascertain the total crop harvested during the life cycle of the sisal plant.

In the cutting trials the effects of the different treatments on subsequent growth are not yet discernible. The only plots ready for cutting in the cultivation trial were those which were kept clean weeded; the sisal under other treatments was backward according to the intensity of weed competition. One positive result attributable to the suppression of weeds is the shortening of the period from planting to the first cut. It is also noteworthy that over seventy per cent of the total number of leaves produced by the clean weeded sisal from planting up to the time of cutting were of economic value. In due course it may be shown that when young sisal is neglected, the period before cutting is prolonged and lower yields may be expected.

The superiority of bulbils over suckers has been demonstrated as far as initial rapid growth is concerned, and in one case their forwardness allowed a light cutting before they had been two years in the field; a second cutting will be available about the time the suckers are ready for a first cutting. This points to the value of using good planting material. Two manurial trials were cut; the fibre yields showed a significant response to applications of nitrogen and phosphate but none so far to potash or lime. Growth records of the spacing trial illustrate more markedly the influence upon the unfurling rate of new leaves of competition between plants. Cutting has been deferred until the closely spaced sisal is sufficiently advanced to withstand unavoidable heavy cutting.

Of the Agave seedlings raised by the Geneticist, Amani, the hybrids of *A. amaniensis* and *A. angustifolia* are most promising; besides developing quickly, many are producing between ten to fifteen leaves per month. A smaller number have smooth-edged leaves of fair length and preliminary examination points to the fibre being fine. The *A. amaniensis* by *A. sisalana*

hybrids and other seedlings of blue sisal are not so impressive. Bulbils from seedling plants at Amani are being tested in progeny rows.

The blue sisal plantation was not cut during the year, except for a small area for specially prepared bales sent to Lambeg. A limited number of blue sisal suckers were supplied to estates, while several thousands of bulbils from Amani were fumigated and packed for estates outside the Tanga Province.

Among other crops grown on the station are derris, *mundulia*, and imported varieties of mangoes and citrus. The citrus nurseries have been considerably enlarged and twenty-five thousand rough lemon seedlings will be available for budding next year and eventually for distribution to sisal estates.

A big step forward has been made in the development of the station. A model labour camp, stores, workshop and garage were erected and plans for a rest-house have been approved. Foundations of the new factory have been started; the single drum decorticator and other machinery have arrived. A large new dam was constructed. A further fifty acres of land were cleared for immediate and future planting requirements. One new trial was planted. A local firm has generously provided a tractor and implements for investigating mechanical cultivation of sisal.

Regular issues of the *Quarterly Notes* are published by the Sisal Growers' Association. Close co-operation is maintained with the staff at Amani and at Lambeg. The department is indebted to Messrs A. G. G. Hill, Director of the East African Agricultural Research Station; J. V. Gray, of Messrs Bird and Company (Africa), Limited; H. Tanner, of the Amboni Estates, Limited; and the Secretary, Kenya Sisal Board, who served on the management committee for the Sisal Station, for the advice and assistance they have so readily given throughout the year.

NORTHERN PROVINCE

The Coffee Research and Experiment Station, Lyamungu

The establishment, *ab initio*, of an experiment and research station for a perennial crop calls for a period of preparation and development. For the coffee research station this essential work has been completed, and the programme of experimentation, authorized by Government in consultation with the industry and outlined in departmental Pamphlet No. 15, can now be applied.

Five years' yield records of certain tentative selections on estates have been completed and trees have been located which appear to fulfil all requirements including liquoring quality. The second stage has now begun; it includes field tests of the seedling progeny of the selected trees to determine their suitability to different localities and conditions of environment. Material is being gradually accumulated of the vegetative progeny of the selections and experimental material and investigation of methods of vegetative propagation continues.

Some fifty experiments are carried out in co-operation with estates. Under the variable climatic conditions obtaining, similar treatments may have different effects from year to year. Thus advice based on the results of these co-operative experiments will not be available for several seasons.

On the station itself a first crop has been taken from the earliest planted experiments and the results of both growth and yield clearly indicate the advantages of rigorous culling of unthrifty seedlings and the thorough preparation of pits before planting. The beneficial effect of banana leaf mulch on young coffee is outstanding.

The new coffee factory has been in use for the first time and about three tons of parchment coffee were produced. The study of nearly one thousand samples of coffee from the experiments is in hand.

Investigation work connected with the improvement of soil fertility takes a prominent place in the programme and areas of elephant grass and guinea-grass have been extended to provide fodder for the herd of cattle which is maintained for the supply of farmyard manure and compost.

The Plant Pathologist has continued experiments on the control of *Hemileia* disease of coffee and observations on shoot growth and leaf fall have been taken at regular intervals on the experiment blocks. A physiological stem-canker of coffee, already reported in 1936, has been studied further. An experiment to investigate possible control methods for *Armillaria* root-rot was begun.

The Entomologist has worked during the year on the two leaf miners of coffee and their parasites in collaboration with the Entomologist, Amani. Work on the *antestia* pest has been continued; new methods of control were tested and a survey of the Meru and Arusha areas was begun in order to elucidate points regarding both the normal methods of control and the economic status of the parasite *Corioxenos antestia*, Blair.

The Chemist has continued investigations on the effect of manuring and mulching on the production of nitrate in connection with field experiments on estates and on the station. The general soil survey has been continued. Soil factors responsible for various disorders of coffee on volcanic ash soils have been studied and the occurrence of alkali salts in the sub-soil is receiving special attention.

Quarterly Notes on the progress of work on the station were published by the Tanganyika Coffee Growers' Association in English and German.

A plot for coffee experiments was generously provided by the planters of the Mbeya district.

The Kahe Cotton Trial Plot

A test planting of cotton was again made on this plot but the crop was almost a complete failure; the yield was no more than 136 pounds of seed cotton per acre over the thirty-five acres which were planted and in addition all the cotton was excessively badly stained. Initial growth was excellent but with the cessation of the rains in June the plants collapsed. The exact cause of the failure is obscure and cannot be ascribed to any single factor.

EASTERN PROVINCE

The Morogoro Agricultural Station

Trials on the Morogoro farm are concerned exclusively with native food crops and soil fertility problems. All work concerned with cotton is now carried out on the Kingolwira farm. The following is a brief review of the work.

Green-manuring has again given better results than cattle manure or compost in the fertility trial; the application of superphosphates only was found to depress crop yields. Experiments indicate that lime is of importance and is necessary if increased yields are to be obtained from the use of cattle manure on the soil peculiar to the station, which, however, is not of wide distribution in the district.

Trials of different varieties of such native food crops as sorghums, sweet potatoes, cassava, yams and beans were continued. Some varieties of

sweet potatoes, cassava and sorghum have given consistently better yields and planting material and seed of these varieties are now being distributed both locally and to other countries.

Investigations regarding the incidence of mosaic and Brown Streak diseases are conducted in co-operation with the Plant Pathologist, Amani. The collection of varieties has been augmented by several new varieties from other districts as well as by importations from Zanzibar, Uganda and Kenya which have been introduced through Amani. Many of these varieties are reputed to be resistant in their country of origin but this quality has either decreased or disappeared in trials at Morogoro.

A new dairy was built and a steam sterilizing chest installed. Sunn hemp hay, with supplements of maize and steamed bone flour were fed to calves and cotton seed to the mature stock with satisfactory results. Milk yields were increased by one pound per day per cow. Individual milk yields have shown improvement, particularly in the native stock. The average yield per lactation for the best nine grade cows was 325 gallons while the average yield for seven of the native cows was 179 gallons with two animals giving 263 and 233 gallons, respectively.

An increase in trypanosomiasis infection occurred in the dairy herd. The cause is obscure but it is believed that the increase in lorry traffic passing the farm may have brought in more fly.

In order to meet the demand for more fruit trees, the nurseries were considerably extended and a large area on the Morogoro farm has been terraced and laid out with irrigation furrows. Approximately fifty thousand rough lemon seedlings were planted to provide stocks for budding improved and selected varieties of citrus. Most attention is given to propagating citrus as expert knowledge and experience and plentiful water supplies are necessary, but other fruits are not neglected and are propagated as planting material and seed becomes available.

The Kingolwira Experiment Station and Rural Development Centre

Experimental work.—Tests on selections from both imported and local cotton were taken a stage further and some promising selections were isolated. The results of mass trials must be awaited before any final decision can be taken as to the suitability of any selections for commercial planting. The Mwanza selections Mz581 and Mz582 and the local selection 244 gave the highest yields; also Mz581 and Mz582 gave higher ginning percentages than the local unselected crop. In the strains trial the numbers 244, Mz561 and 347 were outstanding; the remainder were disappointing.

In addition to experiments concerning the viability and vigour of cotton seed and the density of the plant stand, cultivation trials were laid down to evaluate different methods of land preparation and inter-planting.

Some of the red soils on the ridge tops on the extension farm at Kingolwira have given poor crops, especially grains, during the first year or two of cultivation from bush and in the experiment designed to ascertain the period taken for such soils to come into "good heart," it was demonstrated that maize and millets give significantly lower yields on freshly opened land than on land in its second and third year of cultivation. With cotton the reverse is the case: the yield from plots in their third year being significantly poorer than the first and second year plots.

Rural development.—In the development of the Kingolwira peasant settlement centre ideas regarding the organized settlement of natives are becoming clarified. The settlement has not yet passed the experimental stage but the causes of difficulties and the best methods of overcoming them are becoming evident. So far propaganda to encourage increased settlement has not been made and somewhat fewer applications for holdings were received than in the year before. There are now fifty-five settlers who have taken up holdings including three local families who were living within the boundaries of the settlement.

Owing to the drought, crop returns were lower than usual, nevertheless the average output per settler was at least ten-fold that of the ordinary district peasant cultivator. Satisfactory progress has been made with anti-soil erosion measures. A feature of the settlement is improved housing and an appreciable proportion of the money earned by settlers has been devoted to this. It is obvious that where there is abundance of land, improvident agricultural methods will only be avoided and soil fertility conserved by introducing improved housing in the hope that this will anchor the cultivator to a fixed area.

The position in regard to tsetse fly has not yet permitted the general introduction of cattle but clearing is proceeding and a fresh scheme to protect the settlement from the invasions of fly is being worked out. An officer of the Tsetse Research Department investigated the "fly" position; it was found that *Glossina pallidipes* is more abundant and more widely distributed than was at first realized but there is evidence that the number of *G. morsitans* are being reduced and the incidence of trypanosomiasis in the herd at Kingolwira is decreasing.

Zombe Agricultural Station, Rufiji District

As projected in the report for 1937, the Mpanganya station was closed down and the work transferred to a new area of land at Zombe, near Utete, which provides more typical flood-land conditions. The most important trials which have been laid down are (i) a trial to ascertain the suitability or otherwise of Tokar cotton to Rufiji conditions; (ii) a trial to investigate the interaction of maize, rice and cotton, which crops are normally grown in simultaneous rotation by local natives; (iii) rice variety trials to find a good quality, high valued rice acceptable to the native producer and suited to local conditions.

LAKE PROVINCE

The Ukiriguru Experiment Station and Rural Development Centre

The work of the Ukiriguru station now exercises considerable influence with the peasant cultivators of the Mwanza district. This is especially gratifying as the investigation of suitable methods for the utilization of the heavy *mbuga* or flat valley-bottom lands is of first importance to the problem of over-population in the Lake Province.

The work of isolating, selecting and testing improved varieties of food crops was continued; the main crops dealt with were sorghums, maize, millets, rice, sweet potatoes and a range of pulse crops. Cotton received considerable attention and a number of selections have given heavy yields of good quality lint. Over a period of five years the local selections Mz561, Mz613 and Mz635 have given average increases in yield of 32.0, 9.2 and 17.2 per cent respectively over the control of local cotton. All these selections are up to the standard quality

of local cotton, while a special mixture of local selections yielded 870 pounds of seed cotton per acre as compared with 572 pounds from the control plots.

No new selections of rice from the local varieties were made but the best of the earlier selections have been multiplied and a larger quantity of pure seed was issued; a number of new introductions are now under trial. There has been a big demand for seed of a selection from a local native variety of ground-nuts. The value of a quick maturing maize in a dry season was demonstrated by a selection of the local Katumbili maize. On land infested with the parasitic weed, *striga*, maize again gave a higher yield than sorghum or Bulrush millet.

The wide range of experiments dealing with methods of maintaining soil fertility were continued. Time of planting and spacing trials were carried out with different crops. These have given results of great value from the point of view of increasing the yields of local crops. In the trial to test the different rates of application of farmyard manure a dressing of three tons to the acre gave an increase in yield of grain of thirty-six per cent. Applications of one and two tons gave lower yields. A manurial trial was laid down to investigate the effect of farmyard manure on the yield of cassava and large increases were recorded but natives averred that the fresh roots from manured plots were not as palatable as the roots from unmanured plots; the palatability of the dried roots has not yet been tested.

Seed of improved varieties of a wide range of native crops and proved introductions were multiplied. Seventy tons were distributed to local cultivators or sold to other districts, and three hundred parcels of small quantities of seed were sent from Ukiriguru to other parts of the Territory and abroad. Rhode Island Red poultry has been in greatly increased demand.

The Nyamahona Extension Farm in Uzinza, to the west of Smith Sound, is primarily a cotton multiplication centre attached to Ukiriguru but the farm also deals with such other crops as are likely to be of particular value in Uzinza. The yields of cotton are increasing steadily from year to year as a result of good farming. The farm serves as a very useful demonstration centre to the people who are now immigrating into this part of the district. There are problems which are peculiar to this area and these receive special attention. One of the most important is to evolve sound methods of cultivating and of raising the fertility of the *miombo* bush lands which were generally regarded previously as being infertile and difficult to farm.

On the Nyamahona settlement which is attached to the experimental extension farm there are now one hundred and eighty-six settlers. Generally speaking they did well and obtained ample food. The average cash returns from the sale of crops from seven holdings taken at random amounted to ninety-five shillings, the highest being one hundred and fifty shillings and the lowest thirty-five. The settlers are now bringing cattle into the area and the development of mixed farming will enable them to maintain a higher production than at present.

The Lubaga Experiment Station and Rural Development Centre, Shinyanga District

Many of the experiments on this farm were badly affected by drought. Nevertheless a very satisfactory yield of 814 pounds of seed cotton was obtained from a field scale trial of nineteen acres planted with the 998 variety of cotton. This selection has given consistently good yields and the possibility of substituting it for U/4/4/2 is under consideration. A further ninety-eight selections

from 998 and U/4/4/2 were made and planted in a trial plot. A severe infestation of Jassid during early May did considerable damage to cotton. Stainer (*Dysdercus fasciatus*) were very prevalent and were largely responsible for the very high percentage of stained cotton.

In the maize variety trial the quick maturing native varieties gave better yields under the adverse growing conditions than the introduced types. Accurate analysis could not be made of the results from the groundnut trials because the plot yields were very disproportionate. The results from the manurial trials were disappointing and significant differences were not obtained. Other experiments planted included a comparison between flat and ridge cultivation and a rotation experiment.

As in previous years the ploughing school was available for training oxen. Indiscriminate ploughing in many parts of Sukuma is highly detrimental and oxen are now first trained to carry packs for transporting manure. Over two hundred head of cattle were sent in to Lubaga for training in pack work.

An additional tank dam was constructed to meet the increasing demands which are being made on the farm water supplies. The dam was constructed by using dam scoops and oxen. A simple hand operated water pump on the principle of an Egyptian "Shaduf" pump was erected for demonstration purposes.

The Nyakato Agricultural Training Centre

Following the results of experimental work carried out in former years, simple demonstrations have been laid down to show pupils and visiting natives the outstanding results of manuring the local annual crops in a district where the communal lands can only produce a crop once in four years. A simple rotation of the principal crops of the district with moderate applications of manure in alternate years and a two-year elephant grass (*Pennisetum purpuraceum*) fallow has been established. The quantities of manure used are limited so as to be within the capabilities of any native to manufacture, and the elephant grass, besides ameliorating soil conditions, provides a valuable fodder for cattle and material for native huts. The results from these plots have been outstanding as have the yields from the coffee plots which have been mulched, in contrast to untreated plots.

In order that the results of the important animal husbandry work, carried out in co-operation with the Veterinary Officer, may be applicable to local conditions, a pure-bred Ankole herd has been established in addition to the Zebu and cross-bred animals already kept. Not only has the weight of calves at birth been nearly doubled in the past few years by supplementary feeding but there has been an appreciable reduction in the intervals between calving. Although the increased stamina of the animals, the increased number of lactations and the increased increment to the herd amply justify the feeding of concentrates, these have been reduced to a minimum and local crop residues utilized more fully lest natives be deterred from adopting measures the cost of which seems to them as out of proportion to their visible income. A considerable area has been paddocked to allow of rotational grazing and the improvement of pastures by the elimination of the extremely poor varieties of local grasses.

WESTERN PROVINCE

Tumbi and Mwanhala Agricultural Development Centres

These two farms serve as mixed farming demonstration centres. A few simple experiments concerning particular problems peculiar to these arid,

infertile districts are also carried out. The results of such work is of particular importance to the development of the sleeping sickness concentrations. A new provincial native authority school was built at Mwanhala.

In addition to cultivation and rotation trials, manurial and inter-cropping trials with maize and groundnuts were laid down at these two centres. Applications of manure gave spectacular increases in the yield of maize at both centres; at Mwanhala a dressing of three tons of manure per acre gave an increase of 148 per cent in the yield of maize while a dressing of six tons gave an increase of 239 per cent on the yields obtained from the unmanured control plots.

SOUTHERN HIGHLANDS PROVINCE

The Iheme Experimental Farm, Iringa District

The Iheme farm has played a very valuable role in investigating the practical problems which confront the European settler in the Southern Highlands who had no well-established and ready-made farming system to adopt. A wide range of crops such as temperate grain crops, tobacco, olives, deciduous fruits, vines and pyrethrum has been tried, and reliable advice can now be given regarding the potentialities of these crops, the best methods of growing them and the handling and treatment of them for the market. Farmers are able to see demonstrations of all the processes involved on the farm.

Experimental work on tobacco takes a prominent place in the programme. Pure line selection within the type of tobacco known as "Iheme" was continued and has yielded a plant with broad leaves which do not curl; a fault which increases exposure to "Weather Spot" disease. Experimentation included (i) a topping trial to determine the best stage at which to top fire-cured tobacco under dry land conditions and the best stage for flue-cured tobacco grown under irrigation; (ii) a trial of types of tobacco suitable for flue-curing; (iii) spacing trial; and (iv) fertilizer trials.

Grain crops which are planted for seed multiplication or trial are wheat, maize, barley, oats and buckwheat. Buckwheat is becoming a popular crop with local natives. Wheat trials this year were confined to the rust testers, Governor, B256 G, Reliance, 112 A and 58 F (C-I). In addition to Yellow Rust, it was shown that the Stem Rusts, K3 and K4, were present. The Australian wheat 26.H.20 is very promising; it has the advantage of being resistant to K5 Stem Rust which though not now present will inevitably arrive at some time.

Other field crops on the station are peas, selected types of native beans, German summer vetch, mustard, kudzu vine, *Atemesia brevifolia*, *Pelargonium radula*, lavender, Tung oil, Queensland nut, and Pecan nuts. Trials are being made of a large number of different kinds and varieties of deciduous fruit trees and the Killiekrankie peach has been particularly successful. The olive trees planted under dry land conditions suffered badly from drought.

A herd of seventy-nine cattle is maintained on the farm. Forty-two of these are being trained in ploughing on behalf of natives. Large quantities of compost are made. Agricultural learners were trained and seven passed out and in addition one carpenter-learner and one blacksmith.

PUBLICATIONS

The following pamphlets were published by the department during 1938 :—

- No. 20 : Sisal Experiment Station Report for 1937.
- No. 21 : General Experiment Farms Report for 1937.
- No. 22 : Coffee Research Station Report for 1937.

The following leaflets were published by the department during 1938 :—

Departmental Leaflets

- No. 11 : Notes on Pyrethrum in Iringa. By C. J. McGregor, Agricultural Officer.
- No. 12 : List of Properties Numbered on the Map of Sisal Estates, Tanganyika Territory.

Entomological Leaflet

- No. 16 : Report of the Entomologist for 1937.

Other articles published during the year were as follows :—

- Memorandum on Bacterial Blights of Beans. By G. B. Wallace, Plant Pathologist.
- Some Timing-Acre Figures for the Eastern Province, Tanganyika Territory. By N. R. Fuggles-Couchman, Agricultural Officer.
- Rat Trapping Campaign—Rufiji District. By A. S. Stenhouse, Agricultural Officer.
- Fruit Production in Tanganyika Territory. By A. J. Wakefield, Director of Agriculture.

Articles sent to the *East African Agricultural Journal* for publication were as follows :—

- Notes on the Economic Possibilities of Blue Sisal (*Agave amaniensis*). By G. W. Lock, Agricultural Officer.
- Notes on Two Drug Plants. By T. H. Marshall, Agricultural Officer.
- An Indigenous System of Soil Protection. By B. J. Hartley, M.B.E., Agricultural Officer.
- Kapok in Tanganyika. By T. H. Marshall, Agricultural Officer.
- Pests and Diseases of Kapok. By W. V. Harris, Entomologist.
- A Note on Soil Fertility at Nyakato. By A. H. Savile, Agricultural Officer (incorporated in an article entitled "Essays in Applied Pedology," by Mr G. Milne, Soil Chemist, Amani).
- Root-knot Eelworm. By W. V. Harris, Entomologist.
- Variability in Yield of *Coffea Arabica*. By S. M. Gilbert, Chief Scientific Officer.
- A Note on the Poison Bait used for Rodents in the Kilosa District of Tanganyika Territory. By J. Robertson, Agricultural Officer.

The following were published in the *Manchester Guardian Commercial*:—
Agricultural Production in Tanganyika. By J. C. Eyre, Agricultural Officer.

Sisal Production in East Africa—Natural advantages for its growth. By G. W. Lock, Agricultural Officer.

Other publications were as follows:—

Quarterly Notes of the Sisal Experiment Station.

Quarterly Notes of the Coffee Research and Experiment Station.

Sessional Paper No. 1.—The Kingolwira Peasant Settlement Scheme.

SECTION III.—FINANCE

The financial provision for the period from the 1st of January to the 31st of December 1938, together with the estimated expenditure, is given below. In comparing these figures with those given in 1937, attention is drawn to the fact that "Upkeep of Government Gardens" no longer appears under this department's head in the territorial accounts which results in a saving of £475 under "Other Charges."

A grant of £3,990 was made by the Empire Cotton Growing Corporation towards recurrent expenditure on cotton experimentation and a further £400 was expended from the original capital grant of £6,850, leaving a balance on hand of approximately £30 for expenditure in 1939. As stated under the cotton section above the Corporation authorized continuation for another year of a grant for recurrent expenditure at the rate of the two grants now in force, namely, £4,740 a year. In addition approval was given for capital expenditure in 1939 of the sum of £3,050 mainly required for a tractor with free-felling dam-making and anti-erosion equipment.

The salaries of two ginneries inspectors for the year were again provided by the British Cotton Growing Association.

The continued financial assistance given by the councils of the above bodies is very gratefully acknowledged.

The following are the estimates of direct revenue from fees and taxes in 1938, compared with the sums actually collected during the three previous years:—

	1935 £	1936 £	1937 £	1938 £
Bukoba Coffee Grading Fees ...	2,900	1,329	1,816	1,518
Sisal Tax	4,245	4,141	8,434	10,347
Coffee Tax	2,563	1,372	2,437	3,079
Cotton Tax	5,600	6,336	6,471	5,048

The details of the provision and expenditure referred to above are given in the following table:—

	Provision for the period 1.1.38 to 31.12.38 £	Estimated Expendi- ture for the period 1.1.38 to 31.12.38 £
<i>Personal Emoluments.</i>		
Administrative	5,552	4,986
Scientific Staff	5,134	4,530
Field and Experiment Farm Staff ...	37,208	35,141
Total Personal Emoluments ...	£47,894	£44,657

<i>Other Charges.</i>	Provision for the period 1.1.38 to 31.12.38	Estimated Expendi- ture for the period 1.1.38 to 31.12.38
	£	£
Travelling (including Railway Fares and Freights, Travelling and Transport Allowances, Transport and Maintenance and Running of Motor Vehicles) ...	8,960	8,230
Upkeep of Experiment Stations and Plantations (including part Coffee Research Station), Contribution to Native Treasuries Seed Farms and Minor Improvements to Agricultural Stations	8,934	8,691
Upkeep of Nyakato Agricultural School ...	600	584
Upkeep of Ploughing Schools	200	196
Purchase of Planting Material	100	66
Plant Sanitation	150	106
Purchase of Tools, Implements and Scientific Equipment	275	299
Expenditure on Cotton Tax Services ...	3,000	2,446
Agricultural Development, Special Services	200	183
Special Expenditure, Motor Lorries ...	550	413
Special Expenditure, Maize Sheller ...	—	16
Special Expenditure, Purchase of Terracer General Expenditure (including Books of Reference, Tents and Camp Equip- ment, Uniforms for African Instructors, Typewriters, Upkeep of Museum, Agricultural Shows, Stationery, Bicycles, Electricity and Contingencies) ...	1,118	804
Total Other Charges ...	£24,087	£22,109
GRAND TOTAL ...	£71,981	£66,766

It should be noted that of the total, a sum of no less than £14,513 is provided by reimbursements and cross entries making a net £52,253.

<i>Special Expenditure.</i>	Provision for the period 1.1.38 to 31.12.38	Estimated Expendi- ture for the period 1.1.38 to 31.12.38
	£	£
Empire Cotton Growing Corporation Capital Grant	431	400
Sisal Experiment Station—Capital Expen- diture (excluding Public Works Depart- ment work)	700	679
Coffee Research Station—Capital Expen- diture (excluding Public Works Depart- ment work)	125	125
Total Special Expenditure ...	£1,256	£1,204

In addition to the provision made under the department's head, the following provisions for services connected with "agriculture" were made in the territorial estimates for 1938 :—

	£
Anti-locust Measures	100
Sisal Reconnaissance Survey	200
Development of Peasant Holdings	100
Subventions to :—	
Agricultural Scholarship Scheme	768
Imperial Agricultural Bureaux	252
Imperial Bureau of Entomology	500
Imperial Bureau of Mycology	250
Imperial Economic and Shipping Committees	167
East African Agricultural Research Station	7,592
Kwamkoro Estate	1,404
Colonial Agricultural Service Fund	250
*Coffee Section of the British Empire	
Producers' Organization	152
*Grant to Sisal Board	6,213
Imperial College of Tropical Agriculture, Trinidad	250
*Grant to Coffee Board	1,480
Total ...	£19,678

A list of staff as on the 31st December 1938 is given as Appendix I.

SECTION IV.—LEGISLATIVE CHANGES DURING 1938 AS AFFECTING AGRICULTURAL INDUSTRIES

Coffee.—An Ordinance to amend the Coffee (Tax) Ordinance, 1933, was enacted during the year. It has been found that the amount of coffee produced in certain areas on which tax was collected was negligible and that it was more practicable to collect the tax at the ports of export.

Cotton.—An Order was passed under the Cotton Ordinance, 1937, to the effect that raw cotton throughout the Territory shall be sorted into two grades only.

Sisal.—The Sisal Industry Ordinance, 1938, was enacted to consolidate the existing law relating to sisal-hemp and the Sisal Board and to provide for the registration of sisal plantations and plantation marks, the grading and packing of sisal-fibre and other matters relating to the sisal industry. This Ordinance empowers the Governor in Council to make rules for (a) the compulsory registration of all sisal plantations and compulsory use of plantation marks; (b) the submission of statistical returns in respect of areas under sisal cultivation, particulars of labourers employed on the plantations, stocks of sisal-fibre on plantations and actual production of sisal-fibre by estates; (c) the conditions to be fulfilled in respect of grading, baling, packing and marking sisal-fibre for export.

*From the coffee or sisal tax funds.

Tea.—An Ordinance to provide for the establishment of a Tea Board, for the improvement of the tea industry and to impose a cess on tea manufactured in the Territory was passed under the title of the "Tea Industry Ordinance, 1938." The cess money collected will be expended solely for the benefit of the tea industry, such as propaganda for its marketing.

Sugar.—To regulate the export and production of sugar, the Sugar (Control) Ordinance, 1938, was enacted during the year. This Ordinance was designed to give effect to the International Sugar Agreement which was signed in London on the 6th May 1937.

The exportation of sugar from the Territory to countries other than Kenya and Uganda was limited to the export by the Tanganyika Planting Company of an amount not exceeding 5,100 tons for the period 1st September 1937 to 31st August 1938, by an Order published under the Customs Ordinance.

Food-stuffs.—Several Orders were published during the year prohibiting the removal of native food-stuffs from areas in which they were grown as a precaution against food shortages. The following areas were concerned: Southern Highlands Province; Central Province; Western Province; Songea District of the Southern Province; Maswa, Mwanza and Kwimba districts of the Lake Province, and Mbulu District of the Northern Province.

CONCLUSION

The aim of the department is to follow the centuries old behest that "the best thing we can do with the earth is to cultivate it" but to do so with every regard for the soil. If this precept is followed progress is inevitable but calls for the closest co-operation between the technical departments and the provincial administration. It is with great pleasure that I can acknowledge the willing and ready assistance given to the department by officials of the several branches of the service and non-officials alike. The assistance given by the members of the Coffee, Cotton and Sisal Boards and the Executive Committees of the several Planters' and Ginners' Associations and Chambers of Commerce calls for especial mention. I am also indebted to the Empire Cotton Growing Corporation, the Imperial Institute, the several Imperial Bureaux, the British Cotton Growing Association, the Royal Botanical Gardens, Kew, His Majesty's Eastern African Dependencies Office, the British Empire Producers' Organization, the Board of Trustees for Sisal Research and many firms overseas for valuable advice and support; also to the staff both of the East African Agricultural Research Station, Amani, and the departments of agriculture in neighbouring territories who have been so ready to assist and co-operate in every possible way. Members of the department have not spared themselves in their endeavours to serve the Territory and I would acknowledge this fact and thank them for it.

Morogoro,
11th March 1939.

A. J. WAKEFIELD
Director of Agriculture

LIST OF STAFF AS ON 31st DECEMBER 1938

EUROPEAN STAFF

Director: A. J. Wakefield.

Deputy Director: A. B. Killick (not yet arrived).

Senior Agricultural Officers: R. M. Davies, Moshi; D. Sturdy, Mwanza; H. P. Smart, Dar es Salaam; one vacancy.

Chief Scientific Officer: S. M. Gilbert, Coffee Research and Experiment Station, Lyamungu, Moshi.

Plant Pathologist: G. B. Wallace, Coffee Research and Experiment Station, Lyamungu, Moshi.

Entomologists: W. V. Harris, on leave; F. B. Notley, Coffee Research and Experiment Station, Lyamungu, Moshi.

Chemist: H. B. Stent, Coffee Research and Experiment Station, Lyamungu, Moshi.

Agricultural Officers: J. V. R. Brown, Lindi; C. B. Garnett, Maswa; A. S. Stenhouse, Utete, Rufiji; H. Marsland, Kasulu; C. J. McGregor, Iheme, Iringa; A. H. Savile, Dodoma; N. V. Rounce, Tabora; T. C. Cairns, Arusha; R. D. Linton, Moshi; F. R. Sanders, Bukoba; J. Robertson, Tanga; F. W. Thomas, Mbeya; R. B. Allnutt, Tanga; J. R. Curry, Moshi; N. R. Fuggles-Couchman, Morogoro; G. W. Lock, Sisal Experiment Station, Ngomeni, Tanga; D. Thornton, Ukiriguru, Mwanza; J. G. M. King, Shinyanga; J. C. Eyre, Headquarters; N. M. Wight, Musoma; H. Gillman, Lushoto; R. J. M. Swynnerton, Headquarters; C. J. M. Krige, Kilosa; one vacancy.

On leave.—T. H. Marshall.

On secondment.—B. J. Hartley, M.B.E., to Aden.

Agricultural Officers (Ginnery): N. Field, Morogoro; R. I. Butler, Mwanza.

Senior Agricultural Assistants: T. S. Jervis, Bukoba; B. E. Eustace, Tukuyu.

Agricultural Assistants: R. W. Collett, Songea; G. S. Brown, Mafia; W. Sibly-Warne, Masasi; A. Young, Bugufi; W. C. Clarke, Ukiriguru, Mwanza; R. Seager, Kahama; A. A. E. Weirich, Tunibi, Tabora; B. R. D. Eccles, Nyamahona, Mwanza; H. L. Brett, Bukoba; H. A. B. Fowler, Sisal Experiment Station, Ngomeni, Tanga; R. Silcock, Kingolwira; G. H. Foster, Kingolwira; J. H. McGregor, Iheme, Iringa; E. Pienaar, Handeni; C. E. Allen, Coffee Research and Experiment Station, Lyamungu, Moshi; C. G. Glegg, Shinyanga; L. M. Fernie, Coffee Research and Experiment Station, Lyamungu, Moshi.

On leave.—L. Leslie-Moore, A. Taylor, L. F. Higgins, D. Shepstone.

Senior Overseer, Agricultural Stations: A. H. B. Childs, Bagamoyo.

Senior Recorders, Coffee Research and Experiment Station, Lyamungu, Moshi: K. Johansen, W. Poppleton, J. van Schoor, I. Thomson.

Chief Clerk: D. F. T. Brown, Headquarters.

European Clerk: C. H. Taylor, Coffee Research and Experiment Station, Lyamungu, Moshi.

NON-EUROPEAN STAFF

Overseer, Agricultural Stations: J. T. Singram, on leave.

Mechanic, Coffee Research and Experiment Station, Lyamungu, Moshi: P. M. Joshua.

Clerks: I. R. X. Gomes, on leave; P. J. Joshi, C. O. Mathews, W. H. Cornell, R. V. Joshi, K. Gopalan, N. Fernandes and G. P. Varughese, Headquarters; L. C. Simeons, Moshi; V. K. Pillai, Mwanza; C. B. Gonsalves, Dar es Salaam; A. d'Costa, Coffee Research and Experiment Station, Lyamungu, Moshi.

AFRICAN STAFF

Overseers, Agricultural Stations: Five.

Industrial Instructor: One.

Teachers: Two.

Laboratory Assistants: Three.

Station Foremen: Nine.

Clerks: Fourteen.

Motor Drivers: Three.

Recorders: Six at the Coffee Research and Experiment Station, Lyamungu, Moshi; twenty-one at the Sisal Experiment Station, Ngomeni.

Assistant Mechanic: One.

Agricultural Instructors: Three hundred and fifty.

Messengers: Fifteen.

COUNCILS, BOARDS AND COMMITTEES

COTTON BOARD.

- The Director of Agriculture (*Chairman*).
- The Comptroller of Customs.
- A Provincial Commissioner.
- Mr A. A. Adamjee, O.B.E.
- Major A. King, M.C.
- Mr T. Shearer.
- An officer of the Department of Agriculture (*Secretary*).

COFFEE BOARD.

- The Director of Agriculture (*Chairman*).
- The Financial Secretary.
- The Provincial Commissioner, Northern Province.
- Mr A. L. B. Bennett, D.F.C.
- Mr W. Bueschel.
- Mr W. Ames Mauran.
- Captain H. E. Rydon.
- Dr F. Veit.
- Mr A. Weissmann.
- The Secretary, Tanganyika Coffee Growers' Association (*Secretary*).

SISAL BOARD.

- The Director of Agriculture (*Chairman*).
 - The Financial Secretary.
 - The Provincial Commissioner, Tanga Province.
 - Major Sir William Lead, M.C.
 - Mr J. V. Gray.
 - Mr H. Tanner.
 - Major E. von Brandis.
 - Mr A. M. A. Karimjee.
 - Mr S. Tranter.
 - Major A. King, M.C.
 - Mr W. F. West.
 - Mr P. Warnholtz.
 - The Secretary, Tanganyika Sisal Growers' Association (*Secretary*).
- The Director of Agriculture is also a member of the following bodies:—
- Economic Board.
 - Railway Advisory Council.
 - East African Coffee Producers' Committee.
 - Central Development Committee.
 - Makerere College Council.

LIST OF GINNERIES LICENSED IN 1938

Province and District	Locality	Number of Gins		Licensees
		Saw	Roller	
<i>Eastern :</i>				
		<i>A : Public</i>		
Dar es Salaam ...	Ruvu ...	—	16	Vithaldas Haridas and Co., Ltd.
" ...	Pugu ...	—	18	Abdulrasul and Sons.
Morogoro ...	Morogoro ...	—	22	Tanganyika Cotton Co., Ltd.
" ...	Mikesse ...	—	20	East African Cotton Co., Ltd.
" ...	Ngerengere ...	—	8	Liverpool Uganda Co., Ltd.
" ...	Duthumi ...	—	20	Tanganyika Cotton Co., Ltd.
" ...	Kwa Dihombo ...	—	16	" " "
Kilosa ...	Kilosa ...	—	18	Juma Haji.
" ...	Rudewa ...	—	22	Tanganyika Cotton Co., Ltd.
" ...	Msowero ...	—	14	Kladitis and Samaras.
Bagamoyo ...	Mandera ...	—	20	The Mandera Catholic Mission.
Rufiji ...	Kilimani ...	—	12	Liverpool Uganda Co., Ltd.
" ...	Msomeni ...	—	18	" " "
" ...	Logeloge ...	—	8	East " African " Cotton Co., Ltd.
Ulanga ...	Kiberege ...	—	12	Vithaldas Haridas and Co., Ltd.
<i>Southern :</i>				
Lindi ...	Mtua ...	—	14	Mathuradas Kalidas and Co.
Kilwa ...	Kikanda ...	—	10	Kikanda Cotton Trading Co., Ltd.
Mikindani ...	Mikindani ...	—	5	Keshawji Anandji and Co.
<i>Tanga :</i>				
Korogwe ...	Korogwe ...	—	25	Moshi Trading Co., Ltd.
" ...	Sindeni ...	—	11	" "
<i>Northern :</i>				
Moshi ...	Moshi ...	—	24	Moshi Trading Co., Ltd.
Mbulu ...	Idulu ...	—	18	Jamal Ramji and Co.
<i>Lake :</i>				
Shinyanga ...	Usogore ...	—	12	Bhagwanji Sunderji and Co.
Mwanza ...	Mwanza ...	—	28	Nakasero Trading Co.
" ...	Murutunguru ...	1	24	Ladha Meghjee.
" ...	Ihale ...	—	14	Mwanza Cotton Trading Co., Ltd.
" ...	Bukumbi ...	—	15	Bhagwanji Sunderji and Co.
" ...	Nassa ...	—	20	Narandas Rajaram and Co. (Africa), Ltd.
Kwimba ...	Nyambiti ...	—	20	Lake Province Cotton Co., Ltd.
" ...	Pambani ...	—	17	Kampala General Agency.
Maswa ...	Malampaka ...	—	11	Bhagwanji Sunderji and Co.
Musoma ...	Mugango ...	—	20	Lake Province Cotton Co., Ltd.
<i>Eastern :</i>				
		<i>B : Planters</i>		
Kilosa ...	Berabera ...	—	12	Kimamba Planters' Ginning Co., Ltd.
<i>Southern :</i>				
		<i>C : Private</i>		
Mikindani ...	Marunga ...	1	hand gin	Adolf Baumann.
Lindi ...	Mlinguru ...	1	" "	W. Seitz.
" ...	Mingoyo ...	1	" "	Lindi Estate.
" ...	Matope ...	1	saw gin	Mrs Carolina Roth.

STATISTICS OF RAINFALL

Rainfall in inches, at certain stations in the Territory for the year 1938

Station	Inches	Station	Inches
Amani	84.48	Mahenge	33.97
Arusha	49.16	Mbeya	27.36
Bagamoyo	40.49	Morogoro	32.74
Biharamulo	38.01	Moshi	50.16
Bukoba	84.57	Mpwapwa	21.58
Dar es Salaam	43.71	Musoma	24.31
Dodoma	24.76	Mwanza	33.11
Iringa	25.84	Ngomeni	50.66
Kigoma	31.79	Njombe	29.97
Kilosa	33.20	Old Shinyanga	29.44
Kilwa	42.02	Songea	24.14
Kinyangiri	24.01	Tabora	30.11
Lindi	36.61	Tanga	64.23
Lushoto	47.56	Tukuyu	58.32
Lyamungu	63.34		

